Montana Department of Fish, Wildlife & Parks

2300 Lake Elmo Drive
Billings, MT 59105
March 1, 1994

TO:

Environmental Quality Council
Director's Office, Dept. of Health & Environmental Sciences
Montana Department of Fish, Wildlife & Parks
- Director's Office
- Parks Division
- Fisheries Division
- Wildlife Division
- Regional Supervisors
- Lands Section
- Legal Unit

Janet Ellis, Montana Audubon Council
Montana Wildlife Federation
Montana Stockgrowers Association
Montana State Library
George Ochenski
Montana Environmental Information Center
Department of Agriculture
Agriculture & Biological Science Division - Billings
Custer National Forest
Gallatin National Forest
Bureau of Land Management - Billings
Big Horn County Commissioner/Weed Board
Carbon County Commissioner/Weed Board
Musselshell County Commissioner/Weed Board
Stillwater County Commissioner/Weed Board
Sweet Grass County Commissioner/Weed Board
Yellowstone County Commissioner/Weed Board

Montana Department of Fish, Wildlife & Parks

2300 Lake Elmo Drive
Billings, MT 59105
March 1, 1994

Ladies and Gentlemen:

The enclosed Draft Management Plan and Environmental Assessment (EA) has been prepared for noxious weed management and control strategies for the Department of Fish, Wildlife and Parks' lands in Region Five (Yellowstone, Big Horn, Carbon, Stillwater, Sweet Grass, and Wheatland Counties), and is submitted for your consideration. Questions and comments will be accepted until 5 p.m., April 1, 1994. If you have questions, feel free to contact Ray Berntsen at 252-4654. All comments may be sent to the undersigned at 2300 Lake Elmo Drive, Billings, Montana, 59105.

Thank you for your interest.

Sincerely,

Richard L. Ellis

Richard Ellis
Regional Supervisor

/s
Enclosures

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

DRAFT WEED MANAGEMENT PLAN

PREPARED BY:

Montana Department of Fish, Wildlife and Parks
Region 5
2300 Lake Elmo Drive
Billings, MT 59105

MARCH 1994

EXECUTIVE SUMMARY

INTRODUCTION

This draft plan summarizes weed management concerns and identifies proposed control methods for lands administered by the Montana Department of Fish, Wildlife and Parks (FWP) in south-central Montana (Region 5). The plan emphasizes an Integrated Pest Management approach which considers all site conditions and prescribes cultural, mechanical, biological and chemical weed management practices. Treatment area priorities, control objectives, control methods and monitoring programs are identified.

This plan includes 7 state parks, 38 fishing access sites, 3 wildlife management areas, 2 state fish hatcheries and FWP regional headquarters (Table 1). These sites have a combined acreage of approximately 8858 acres.

EXISTING WEED CONDITIONS

Many sites administered by FWP in Region 5 have been invaded by leafy spurge, knapweed and other common weeds due to soil disturbance from various activities. Important factors related to early weed invasion include the close proximity of FWP sites to water and roads and the frequent visitation by people and vehicles. The most common weed on Region 5 FWP lands is leafy spurge. Spotted knapweed, Canada thistle, hounds tongue, poison hemlock, the common dandelion and cheatgrass are other common weeds on these sites.

PAST WEED CONTROL EFFORTS

Past weed control efforts in FWP Region 5 have included mowing, grazing, weed-whipping, hand pulling and chemical herbicide applications. The principal target of these efforts has been leafy spurge and spotted knapweed. Over half of these lands have had some type of past weed control.

SITE CONDITIONS

Site conditions vary in rainfall, soils, presence of surface water, depth to groundwater and other important factors. Many sites however have sufficiently similar conditions to develop common guidelines for weed control and environmental protection.

The local climate is dry and cold with an annual precipitation of 13-15 inches on most sites. Most soils are rocky (shale and sandstone), sandy, porous, low in organic matter, weathered from a variety of rock types and deposited by moving water (alluvium). Most sites include surface water (streams or lakes) and also

have shallow groundwater underlying at least a portion of the area. Vegetation is dominated by grassland and dry forest types.

WEED MANAGEMENT OPTIONS

Alternative Control Methods for pest management include cultural, mechanical, biological and chemical techniques. Cultural weed control methods concentrate on establishing and maintaining healthy, vigorous, desirable plants which can resist pest invasion. Cultural control also seeks to minimize soil disturbance so weeds have less opportunity to become established. **Mechanical** control methods physically remove undesirable plants or plant parts especially seed heads. **Chemical** weed control methods use herbicides kill weed pests directly. **Biological** control methods mainly consist of releasing organisms (usually insects, pathogenic microbes or predators) which attack the pest. These methods are not usually designed to control the pest in a short time period but to reduce its numbers to more tolerable levels over longer periods.

PROPOSED MANAGEMENT ACTIONS

FWP Region 5 proposes to initiate a weed management plan emphasizing an Integrated Pest Management (IPM) approach. Weed management is a complex task and requires complex solutions with the flexibility to change as new information is gathered, new control methods become available and new weed problems arise. This plan follows a step by step format with the ability to be modified as necessary.

STEP 1 - WEED CONTROL STRATEGIES FOR EACH WEED

In this step we propose what to do about each individual weed (prevent, eradicate, reduce, contain or tolerate).

STEP 2 - WEED CONTROL METHODS

In this step we selected the tools we propose for use in controling weeds emphasizing an Integrated Pest Management approach and including cultural, mechanical, biological and chemical methods. Cultural and mechanical control methods will be used as the preferred method wherever labor and budgets allow. Chemical weed control will be used more extensively in the early stages of this weed management plan to provide effective initial control at a reasonable cost. Over time, the goal of this plan is to replace chemical control with cultural and mechanical control methods. FWP will also continue to support development of biological weed control methods.

STEP 3 - WEED MANAGEMENT ZONES

In this step we divide up our sites into zones with similar physical and ecological conditions and which can receive similar weed control treatments. Examples

include water quality protection zones, sensitive species zones, human use zones and general weed management zones. Each FWP site will be mapped into weed management zones.

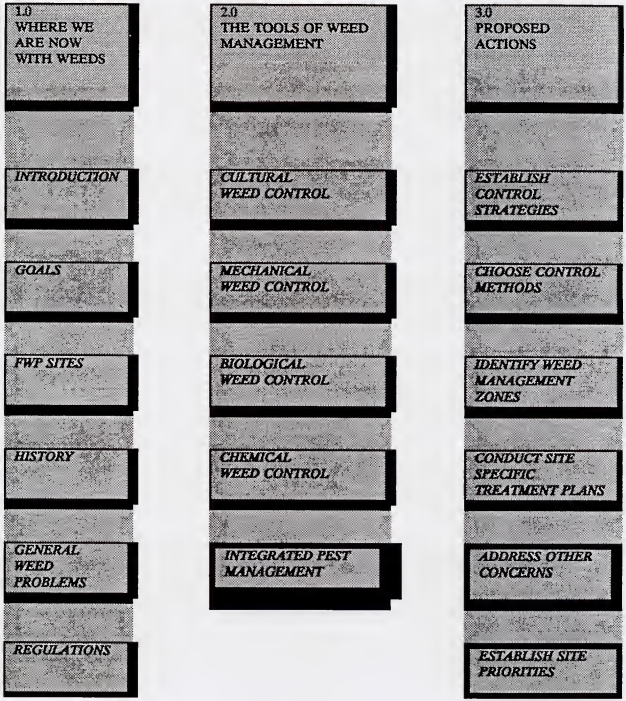
STEP 4 - SITE-SPECIFIC WEED CONTROL PLANS
A procedure has been proposed to complete site-specific weed control plans for all sites to inventory present conditions, identify threatened, endangered and sensitive (TES) species, delineate weed management zones, assess treatment priority and prescribe specific weed control measures.

STEP 5 - SITE TREATMENT PRIORITY LIST
In this step we propose criteria for prioritizing FWP sites in Region 5. Limited manpower and budgets will not allow immediate weed control on all sites.

Additional information provided in this plan includes treatment of species of special concern, monitoring, record-keeping, contracted services, notification, emergency spill response and education.

TABLE OF CONTENTS

COMPONENTS OF THE FWP REGION 5 WEED PLAN



1.0 WHERE WE ARE NOW WITH WEEDS

INTRODUCTION

GOALS

FWP SITE CONDITIONS

HISTORY OF WEEDS

GENERAL WEED PROBLEMS

REGULATIONS AND AGENCY GUIDELINES

1.1 INTRODUCTION

This draft plan summarizes weed management concerns and identifies proposed control methods for selected lands administered by the Montana Department of Fish, Wildlife and Parks (FWP) in south-central Montana. The plan emphasizes an Integrated Pest Management approach which considers all site conditions and prescribes cultural, mechanical, biological and chemical weed management practices. Land management activities are encouraged which prevent soil disturbance and weed establishment. Treatment area priorities, control objectives, control methods and monitoring programs are identified.

1.2 GOALS

The goals of this plan are to:

- Comply with existing weed control laws.
- Reduce the influence of weeds on native plants and animals.
- Accomplish weed control without significant adverse environmental effects.
- Reduce impacts on adjacent lands from weed infestations on FWP lands.

1.3 FWP REGION 5 SITE CONDITIONS

This plan covers 7 state parks, 38 fishing access sites, 3 wildlife management areas, 2 state fish hatcheries, and Region 5 headquarters (Table 1). These sites have a combined acreage of approximately 8858 acres. Elevations range from approximately 2700 - 5000 feet. Annual precipitation is 13-15 inches on most sites but ranges up to 20-25 inches in a few cases. Most soils are rocky and sandy, porous, low in organic matter, weathered from a variety of rock types and deposited by moving water (alluvium).

Many of these sites have sufficiently similar conditions to develop common guidelines for weed control and environmental protection. Most sites include surface water (streams or lakes) and also have shallow groundwater underlying at least a portion of the area. Vegetation is dominated by grassland and dry forest types. A wide variety of terrestrial and aquatic wildlife use these areas.

A "typical" FWP site:

- Access road
- Parking area
- Surface water body (lake or stream)

- Restrooms
- Boat ramp or boat access (half of sites)
- Concentrated public use

Table 1 illustrates important characteristic of these sites. Also presented are the general extent and type of weeds noted in a 1985 inventory.

TABLE 1. WEED AND SITE INVENTORY SUMMARY

AREA Site	TOTAL ACRES	INFESTED ACRES	WEEDS PRESENT	PAST CONTROL	SW[1]	SGW[2]	SOIL CLASS	BOAT RAMP
BIG HORN								
(1) Mallards Landing	22	12	CT-S, SK-S, HT-S	MCW	Yes	Yes	Sl, L, GR,	
(2) Big Horn	78	10	CT-S, HT-S, FB-L, SK-L	MCW	Yes	Yes	Sl, L, GR	
(3) Two Leggins	30	4	CT-M, FB-L	MCW	Yes	Yes	Sl, L, GR	
(4) Arapooish	93	10	CT-S, DK-M, FB-L	MCW	Yes	Yes	Sl, L, GR	
(5) General Custer	33	16	CT-S, DK-H, FB-L, RK-S	MCW	Yes	Yes	Sl, L, GR	
(6) Manual Lisa	38	5	CT-L-HT-L	MCW	Yes	Yes	Sl, L, GR	
(7) Grant Marsh	140	10	CT-S, SK-L, DK-M, SK-L	MCW	Yes	Yes	Sl, L, GR	
STILLWATER								
(8) Fireman's Point	172	7	CT-S, SK-L, HT-L	MCW	Yes	Yes	GR, SI, R	
(9) Swinging Bridge	4	4	CT-L, SK-L, LS-L	MCW	Yes	Yes	GR, SI, R	
(10) White Bird	21	12	CT-L, SK-L, LS-H	MCW	Yes	Yes	GR, SI, R	
(11) Absaroka	1	1	CT-L, LS-L	MCW	Yes	Yes	GR, SI, R	
(12) Cliff Swallow	160	10	CT-L, LS-L	MCW	Yes	Yes	GR, SI, R	
(13) Castle Rock	80	7	CT-L, HT-L, B-L	MCW	Yes	Yes	GR, SI, R	

TABLE 1. (CONT.)

AREA Site	TOTAL ACRES	INFESTED ACRES	WEEDS PRESENT	PAST CONTROL	SW[1]	SGW[2]	SOIL CLASS	BOAT RAMP
(14) Moraine	60	10	CT-L, HT-S, ST-S	MCW	Yes	Yes	GR, yI, R	
(15) Buffalo Jump	6	3	CT-L, LS-L	MCW	Yes	Yes	GR, SI, R	
(16) Rosebud Isle	9	9	CT-L, LS-H, HT-L, B-L	MGCW	Yes	Yes	GR, SI, R	
ROCK CREEK								
(17) Water Birch	77	10	CT-L, SK-S	MCW	Yes	Yes	GR, SI, R	
(18) Bull Springs	32	16	CT-L, SK-S	MCW	Yes	Yes	GR, SI, R	
(19) Beaver Lodge	60	5	CT-L, SK-S	MCW	Yes	Yes	GR, SI, R	
(20) Horsethief Station	84	12	CT-L, SK-S	MCW	Yes	Yes	GR, SI, R	
YELLOWSTONE								
(21) Buffalo Mirage	10	5	CT-L, LS-H	MCW	Yes	Yes	L, SI, GR	
(22) Indian Fort	18	10	CT-L, LS-H, HT-L	MGCW	Yes	Yes	SI, S, GR	
(23) Bratten	102	40	CT-S, LS-H, BT-S, HT-S	MGCW	Yes	Yes	SI, S, GR	
(24) Pelican	121	62	CT-S, LS-H, BT-S, PH-L	MGCW	Yes	Yes	SI, S, GR	
(25) Otter Creek	27	7	CT-L, LS-S	N	Yes	Yes	SI, S, GR	
(26) Grey Bear	45	25	CT-S, LS-M, B-L, PH-L	MCW	Yes	Yes	SI, S, GR	

TABLE 1. (CONT.)

AREA Site	TOTAL ACRES	INFESTED ACRES	WEEDS PRESENT	PAST CONTROL	SW[1]	SGW[2]	SOIL CLASS	BOAT RAMP
(27) East Bridge	1	.50	CT-L	CW	Yes	Yes	GR, S	
(28) Captain Clark	161	85	CT-S, LS-M, SK-L, B-L, PH-L	MCW	Yes	Yes	GR, L, S	
(29) Gritty Stone	13	7	CT-L, LS-L, SK-L, B-L	MCW	Yes	Yes	GR, L, SI	
(30) Voyagers Rest	20	10	CT-L, SK-L, LS-L, B-L	MCW	Yes	Yes	GR, L, SI	
BOULDER								
(31) Big Rock	69	69	CT-H, LS-H, PH-L	MGCW	Yes	Yes	GR, SI, R	
(32) Boulder Forks	72	32	CT-M, LS-L, HT-L	MCW	Yes	Yes	GR, SI, R	
(33) Natural Bridge	40	10	CT-L, HT-L, SK-M	MCW	Yes	No	GR, SI, R	
MUSSELSHELL								
(34) Selkirk	256	125	CT-M, PH-L, SK-S, B-L	MCW	Yes	Yes	L, SI, GR	
OTHER REGIONAL SITES								
(35) Bluewater Springs	90	50	CT-S, PH-L, LS-S	MCW	Yes	Yes	L, C, Gr	
(36) Big Lake	1,849	50	CT-L, ST-S	N	Yes	Yes		
(37) Haymaker	1,321	100	CT-L, HT-S	G	Yes	Yes		

TABLE 1. (CONT.)

AREA Site	TOTAL ACRES	INFESTED ACRES	WEEDS PRESENT	PAST CONTROL	SW[1]	SGW[2]	SOIL CLASS	BOAT RAMP
(38) Silver Run	656	5	CT-S, SK-S	C	Yes	Yes	L, GR	
(39) Yellowstone Hatchery	8	1	CT-S	MCW	Yes	Yes	SI, L, C	
(40) Bridger Bend	12	6	CT-L, ST-S	N	Yes	Yes	L, SI, GR	
(41) Broadview Pond	55	5	CT-L, ST-S	N	Yes	Yes	L, C	
(42) Homestead Isle	194	100	CT-L, L-S	N	Yes	Yes	SI, S, GR	
R-5 PARKS								
(43) Cooney	304	152	CT-S, SK-H	MGSCW	Yes	No	C, L, GR	
(44) Lake Elmo	119	7	SK-L, DK-M, CT-L	MCW	Yes	Yes	L, S, C	
(45) Pictograph Caves	22	4	CT-L, SK-C	MCW	No	No	L, RK	
(46) Deadman's Basin	617	35	CT-S, LS-L, SK-H	MSCW	Yes	No	C, L, GR	
(47) Prairie Dog Town	97	50	BT-L, CT-S, HT-S	MW	No	No	C, L, GR	
(48) Plenty Coups	194	45	CT-H, B-H, HT-L, PH-L	MSCW	Yes	Yes	SI, L, C	

TABLE 1. FOOTNOTES AND EXPLANATIONS

1 (SW) - Surface water at the site (yes or no)

2 (SGW) - Shallow ground water table (< 10 ft)

WEEDS

N -	None
BT-	Bull Thistle
CT-	Canada thistle
D -	Dandelion
LS-	Leafy Spurge
SK-	Spotted knapweed
TF-	Dalmation Toadflax
PH -	Poison Hemlock
PK -	Diffuse Knapweed
B -	Burdock
HT -	Hounds Tongue
ST -	Sow Thistle
FB -	Field Bindweed
RK -	Russian Knapweed

CONTROL EFFORTS

N -	None
M -	Mowing
I -	Irrigation
G -	Grazing
S -	Soil sterilant
C -	Other chemical herbicides
W -	Weedeater

BOAT RAMPS

I - Improved boat ramp
N - None
R - Raft landing
U - Unimproved boat ramp

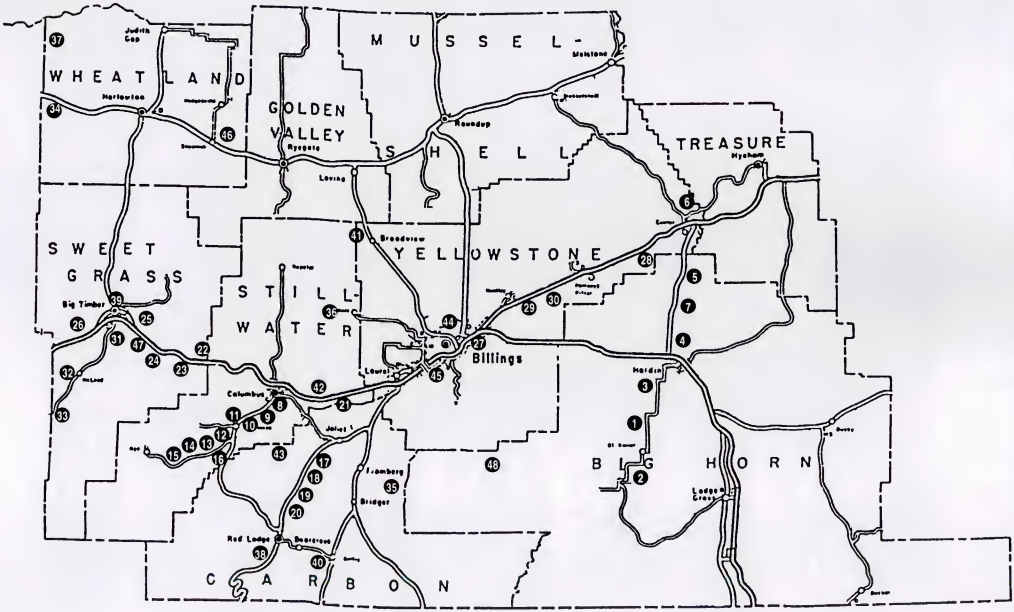
COVERAGE

L -	Low (1-10%)
S -	Scattered (<10% cover)
M -	Moderate (10-25%)
H -	High (>25%)

SOIL CLASSES

GR -	GRAVELLY
S -	SANDY
SI -	SILTY
C -	CLAYEY
L -	Loamy
R -	River Wash
RK -	Rock Land

REGION 5 WEED MANAGEMENT SITES



1.4 HISTORY

Exotic (non-native) weedy plants have been noted in south-central Montana throughout this century. In the past few decades, some of these plants have become significant components of local vegetation communities, actually dominating some sites. The displaced native species are often more desirable for wildlife food and cover, for erosion control and for visual quality. Weeds may reduce vegetation biodiversity directly (the number of species) and therefore limit the diversity of dependent wildlife species.

Many sites administered by FWP were invaded by leafy spurge and knapweed and other common weeds due to soil disturbance by various activities. Important factors related to weed invasion include the close proximity of FWP sites to water and roads and the frequent visitation by people and vehicles. These activities promote site disturbance and seed dispersal.

Past weed control efforts at these sites have included mowing, weed whipping, grazing, hand pulling and chemical herbicide applications. The principal target of these efforts has been leafy spurge and spotted knapweed. Most of these sites have had some type of past weed control.

Small chemical applications have been made by FWP maintenance personnel, especially soil sterilant in parking areas. Region 5's large scale application is done mostly by contracted service with county weed personnel and an occasional private applicator. In a few cases, cooperative efforts have been made with neighboring landowners to coordinate weed control. FWP Region 5 currently has a licensed pesticide applicator under contract.

1.5 GENERAL WEED PROBLEMS

Weeds are present on all FWP sites but the number and total coverage vary considerably. The most common weeds on local FWP lands are leafy spurge and spotted knapweed. Canada thistle, Hounds Tongue, and Poison Hemlock are other common noxious weeds.

Weed densities at FWP sites range from scattered individual plants to a moderate cover of individual weeds, especially leafy spurge and spotted knapweed. Infested sites include parking areas, boat ramps, roadsides, streambanks, lake shores and other disturbed areas.

A weed inventory was conducted by FWP maintenance personnel in 1985 (see table 1). This inventory was not comprehensive and did not include all species currently listed as noxious in Montana (sulfur cinquefoil).

Exotic plants such as leafy spurge and spotted knapweed dominate many FWP lands which were originally much more diverse and abundant plant communities. These weedy areas generally provide less valuable forage and cover for most wildlife species. Weeds also provide less protection from soil erosion by wind and

water. Where weeds occupy streambanks and lake shores, they provide much less stability and erosion control than the original vegetation (Hansen 1988).

For the purpose of this report, weeds are considered as all exotic (non-native) plants. This definition includes introduced grasses such as Kentucky bluegrass, quackgrass, and cheatgrass. Also included are erosion control and reclamation grasses such as crested wheatgrass, hard fescue, sheeps fescue, and others. These exotic grasses are considered weeds because they are invasive, persistent, and often out-compete native plants. None of these grassy weeds are listed as "noxious weeds" and very little direct attempts are made to control their influence or spread. Management may be limited to reseeding areas of weedy grasses to native species when they are disturbed for construction or other reason.

1.6 REGULATIONS AND AGENCY GUIDANCE

Montana has recognized the damaging effects of weeds in laws and regulations such as the Montana Weed Control Act. The Montana list of recognized noxious weeds is presented in Appendix A. Individual counties in Region 5 have adopted local weed management plans. Other state and federal regulations affect weed control programs such as the Montana Pesticides Control Act.

State and local laws require landowners to control noxious weeds. However, in some cases these regulations are not strictly enforced especially in the spotted knapweed areas of south-central Montana. The Montana Noxious Weed Control Act (Title 7, Chapter 22 Sections 7-22-2101 through 7-22-2153 and rules 4.5.201 through .5.203) requires control of specific weeds:

"It is unlawful for any person to permit any noxious weed to propagate or go to seed on his land, except that any person who adheres to the noxious weed management program of his district or who has entered into and is in compliance with a noxious weed management agreement is considered to be in compliance with this section" (7-22-2116 MCA).

FWP has general policies which concern weed management including the departments' vision statement:

"to provide for the stewardship of the fish, wildlife, parks and recreational resources of Montana, while contributing to the quality of life for present and future generations"

FWP also has developed specific weed management policies. A 1983 statewide weed control management plan established the objective:

"to prevent, to the extent feasible, the reproduction and distribution of agriculturally undesirable plant species throughout department land or from department lands onto adjacent lands"

The statewide plan provides guidance for considering weed control which emphasizes conditions and control efforts on adjacent lands, noxious list status and available resources. Appendix B lists laws and regulations related to weed control in Montana.

CULTURAL CONTROL METHODS

MECHANICAL CONTROL METHODS

BIOLOGICAL CONTROL METHODS

CHEMICAL CONTROL METHODS

INTEGRATED PEST MANAGEMENT

2.0 THE TOOLS OF WEED MANAGEMENT

Alternative Control Methods for pest management include cultural, mechanical, biological and chemical techniques.

2.1 CULTURAL AND MECHANICAL CONTROL METHODS

Cultural weed control methods concentrate on minimizing soil disturbance and maintaining healthy, vigorous, desirable plants which can resist weed invasion. Mechanical control methods include partial or total destruction of weeds. Plants may be hand pulled, plowed under, mowed or weed-whipped. Special efforts are made to prevent seed from developing and maturing. Examples of cultural and mechanical controls suitable to FWP sites include:

Prevention

Minimizing soil disturbance and maintaining healthy, vigorous vegetation provides the best defense against weed invasion. Weeds take advantage of space created by disturbance. The goal of this method is to reduce factors which affect plant competition with weeds such as grazing, cultivation, traffic, burrowing animal activity and other soil disturbances. Construction activities must be planned to minimize soil disturbance and provide for revegetation as quickly as possible. Topsoil, gravel and sand sources must be weed-free.

Revegetation

When plant communities are completely disturbed by construction or are entirely dominated by weeds, complete revegetation is required. Revegetation of weedy areas requires significant initial expense to eliminate existing weeds, prepare a seedbed and re-plant but usually produce dramatic results. In radically disturbed areas, it is essential to revegetate as quickly as possible. Topsoil should be salvaged and replaced on the disturbed site as soon as possible to encourage native species to sprout from seed, rhizomes and other plant part in the salvaged soil.

Digging, Hand Pulling and Cultivation

These methods are appropriate for some areas, where infestations are small and plants are small. Large-scale cultivation requires sizable acreages accessible by farm-type machinery to be cost-effective. Complete removal of all plant parts, especially roots, is difficult and varies by weed species, soil moisture conditions and other factors. These methods are most often used where chemical control is not possible such as near water, or when sensitive species are present which may be affected. These methods are applicable to FWP sites but require tremendous manpower. They might best be considered for volunteer group efforts.

Mowing and Weed Whipping

Mowing is a common tool used to improve appearances but does not eliminate the weed plants themselves. Mowing may however be very effective at reducing seed production especially with weeds that produce only one brief crop of seed. Some weeds such as spotted knapweed have a very long season of seed production and it is difficult to eliminate all seed production. Knapweed may flower to a limited extent below mower height.

Mowing height is an important part of weed control. Low mowing heights favor weed germination and growth by exposing the soil to more sunlight and stressing the mowed vegetation. Mowing heights of 4-6 inches or more should be used where possible.

Mowing, especially early in the season may harm native grasses. Where native grasses, especially bluebunch wheatgrass, are an important component of the plant community, mowing should be delayed until grasses mature.

Irrigation
Irrigation can be used to control some weeds. Spotted knapweed is very specifically adapted to dry site conditions and may be controlled or eradicated by applying irrigation water. Irrigation can be used to help establish vigorous stands of desirable plants quickly and encourage root development. Irrigation may also stimulate the weed growth so it must be used with consideration of site specific conditions.

Fertilization
Weeds are adapted to very harsh site conditions and may have a competitive advantage on some sites, especially where soil disturbance has occurred. Fertilization is sometimes used to provide desirable species with the needed nutrition to better compete with weeds. Fertilization may also stimulate weed growth so it is usually used only when nutrient levels are too low for the growth of desired plants.

Mulching
Mulching with plant materials, landscaping fabric and other substances is an effective control method for small areas if installed and maintained properly. Mulching may also improve soil conditions such as aeration, water and nutrient holding capacity and infiltration.

Traffic control
Since weeds have the advantage in disturbed, compacted, trampled conditions, implementation of traffic controls will reduce weed invasion and spread.

User education
Most weed control efforts require the cooperation of informed users and efforts must be made to educate them about goals, methods and results. Cultural controls can be very effective if the public cooperates. Mechanical control programs are so labor and cost intensive that they may only be possible with the aid of volunteer organizations and individuals. Biological methods need public sector funding support for research and releases. Public education is needed to foster the understanding and support for biological control programs. Public education must continue on the use of chemical control methods to address issues of weed control, environmental impact and human health.

Health Effects
Cultural and mechanical weed control methods have health risks including back and other muscle strain from pulling weeds, using hand tools or performing other manual labor tasks. Health risks are also associated with equipment use.

2.2 BIOLOGICAL CONTROL METHODS

Biological control methods mainly consist of releasing organisms (usually insects, pathogenic microbes or predators) which attack the pest. These are often cultured forms of naturally occurring pest enemies. These methods are not usually designed to control the pest in a short time period but to reduce its numbers to more tolerable levels over longer periods (USDA 1989).

Although current biological methods are not effective at controlling local weeds, progress is encouraging and deserves continued support (Story 1979). A list of local biological weed control agents is presented in Appendix C. These biological agents include moths, flies, nematodes, beetles, gallflies, weevils and fungi which specifically attack six of our most common local weeds.

Biological control is not a "quick fix" but should provide substantial benefits over the long term. Cultural and chemical controls may still be needed to achieve initial control and for large periodic outbreaks. Long term costs of biological control should be low as environmental equilibrium is reached. Short-term costs will be substantial to investigate and commercially produce needed control organisms. FWP will continue to encourage research on biological control and will participate in control organism release opportunities whenever possible.

Livestock grazing, especially using sheep and goats, has been identified as a "biological" control agent for leafy spurge and other weeds. The general effectiveness of this method is the subject of debate. Careful monitoring of grazing animals, target weeds and nontarget plants is requires to evaluate success and prevent unplanned damage to desirable vegetation.

2.3 CHEMICAL CONTROL METHODS

Chemical weed control methods use herbicides to kill weed pests directly. Concerns with chemical control include human health risks and environmental impacts, especially to water supplies, wildlife and nontarget plants. Chemical control is usually the most effective, easiest and least expensive for short-term control.

2.31 CHEMICAL PESTICIDES

Over the past half-century, chemical pesticides have been developed to effectively and inexpensively control a variety of pests including weeds, insects and fungi. While the benefits of chemical herbicides are obvious, some have been found to have serious consequences on human health and the environment. Pesticide manufacturers have responded with attempts to develop products that are:

* more pest-specific (kill the pest and not other organisms)
* less toxic to humans, birds, fish and other animals
* less likely to impact the environment especially water quality

Some of the major issues related to chemical pesticide use are discussed below. Detailed information on the specific herbicides proposed for use is presented in Appendix D.

Control Effectiveness
Properly used chemical herbicides are usually very effective against their target pests. Variation in effectiveness occurs due to rates of application, environmental conditions, skill of the applicator, condition of the equipment and other factors.

Costs
Chemical pesticides are relatively inexpensive to apply. Many commercial herbicide applications cost $10-30/acre. These costs are usually a small fraction of the cost for mechanical eradication such as hand pulling.

Health Effects
A definitive evaluation of health effects from pesticides is beyond the scope of this plan. The long-term health effects of chemical pesticides continue to be researched. Short-term health effects can be serious for sensitive individuals. Health effects are most commonly reported among pesticide applicators. Due to uncertainty over health and environmental effects, the goal of this plan is to reduce or eliminate the use of chemical pesticides over time. Our discussion of health effects includes toxicity, carcinogenicity and mutagenicity.

Pesticide Toxicity
Toxicity tests are used as standard reference experiments to evaluate potential harm to mammals and other organisms. Toxicity tests on mammals are segregated into acute, subchronic and chronic categories based on the length of exposure to the pesticide. Acute tests evaluate the effects of large dosages in a short time period. Observations are conducted over a span of days to weeks. The most often referred to indices for pesticide toxicity is the median lethal dose (LD50) and the median lethal concentration (LC50). This is defined as the dose or concentration which is lethal to 50 percent of the treated population (expressed in milligrams of compound ingested per kilogram of body weight). Various rating systems are used to discuss relative toxicities of pesticides. The US Environmental Protection Agency (EPA) has category guidelines for acute and subchronic toxicity which are used on pesticide labels (Table 2). Labels are required under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Table 3 illustrates the relative toxicity of common pesticides and other substances including those used historically by FWP. Note that many of these pesticides are rated less toxic than table salt and aspirin according to the standardized tests. Comparison with table 2 reveals that the herbicides proposed for use by FWP are slightly to moderately toxic. This does not guarantee that their total health effect is benign but may illustrate relative risk.

TABLE 2. TOXICITY RATINGS FOR ACUTE ORAL DOSES IN HUMANS*

Toxicity Rating	Classification	LD50 (mg/kg)	Probable Lethal Oral Dose for Average Adult Human
1	Super Toxic	< 5	< 7 drops
2	Extremely toxic	5 to 49	7 drops to 1 tsp.
3	Very toxic	50 to 499	1 tsp. to 1 oz.
4	Moderately toxic	500 to 4999	1 oz. to 1 pint
5	Slightly toxic	5000 to 14999	1 pint to 1 qt.
6	Practically non toxic	> 15000	> 1 qt.

* From USDA Agriculture Handbook 633

TABLE 3. TOXICITY OF COMMON PESTICIDES AND REFERENCE MATERIALS

CHEMICAL (TRADE NAME)	USE	ORAL* RAT LD50	ORAL*** HUMAN LD50
PARATHION	Insecticide	3-13	.0005 - .002
NICOTINE (TOBACCO)	Tobacco product	50-60	.008 - .009
DDT	Pesticide - banned	115	.017
PARAQUAT	Insecticide	138	.02
2-4,D (component of CURTAIL)	Broadleaf herbicide	300-1000	.05 - .15
ATRAZINE	Herbicide - kills grass	660 - 5100	.1 - .8
DICAMBA (BANVEL)	Broadleaf herbicide	1000	.15
ASPIRIN	Pain reliever	1000-2000	.15 - .3
MALATHION	Insecticide	1375	.2
PICLORAM** (TORDON)	Broadleaf herbicide	2000 - 4000	.3 - .6
SODIUM CHLORIDE (TABLE SALT)	Condiment	4000 - 5000	.6 -.8
CLOPYRLID** (STINGER)	Broadleaf herbicide	>5000	>.7
IMAZAPYR** (ARSENAL)	Non-specific herbicide	>5000	>.7
GLYPHOSATE** (ROUNDUP)	Non-specific herbicide	5600	.8

* Lethal dose in MG/KG of body weight for 50% of the test animals (rats) - the lower the number, the more toxic the substance.

** Pesticides currently used or proposed for use in FWP Region 5.

*** Estimated lethal dose in pounds for a 150 pound person - estimated from male rat data using a conversion factor for mg/kg to lbs/150 lbs of .00015018 These numbers are not precise but provide a relative idea of lethal doses.

Carcinogenicity and Mutagenicity

Chronic impact studies expose a test subject to a pesticide for a majority of its life span to determine the effects of long-term, low-level exposure. The potential for mutagenicity, carcinogenicity and teratogenicity is evaluated. These tests are very complex in relation to human biological systems and potential influences. There can be no doubt that pesticides have had serious health effect for some individuals who are especially sensitive. It is likely that the true effects on the general population will not be known for some time due to the relative short period of historical use and the length of time needed to determine conclusive trends. Table 4 illustrates activities needed to increase an average persons risk of cancer by one-in-one million based on current studies.

Current data suggest that heath risks from pesticides can be significant especially for sensitive individuals. At the same time, it seems theoretically possible to reduce pesticide risks to levels equivalent to other common risks. This is accomplished by proper storage, use and disposal including the use of protective clothing. Since health data is inconclusive, it seems prudent to minimize exposure to pesticides.

Environmental Effects

Environmental effects other than those on human health are another serious concern when considering chemical herbicide use. Impacts have included groundwater and surface water contamination as well as direct effects on wildlife, especially fish and birds. Other, less obvious effects on beneficial insects, crops and other non-target organisms have been the subject of lengthy debate. Pesticides are evaluated in terms of their persistence, potential for movement and pathways or mechanisms of breakdown.

Persistence

Pesticides are degraded by physical, chemical and biological mechanisms. They are also exposed to metabolitization, decomposition, biodegradation and photodegradation. Pesticide persistence is usually expressed in half-life, which may range from one day to several years. Most pesticides are degraded to very low levels in soil after several weeks or months. Some are designed for multi-year persistence and may last several years.

TABLE 4. GENERALIZED SUMMARY OF ENVIRONMENTAL INFLUENCES WHICH INCREASE CANCER DEATH RISK BY ONE IN ONE MILLION.

SOURCE OF RISK	AMOUNT OF EXPOSURE
Herbicide worker spraying:	2,4-D (Component of Curtail): 137 days. picloram (Tordon): 11,236 days. glyphosate (Roundup): 41,667 days.
Cosmic rays:	One transcontinental round trip. Living 1.5 months in Colorado. Camping at 15,000 ft for 6 days.
Eating and drinking:	40 diet sodas (saccharin). 6 lbs of peanut butter (aflatoxin). 180 pints of milk (aflatoxin).
Other:	Smoking 2 cigarettes. 2.5 months in masonry rather than wood
building.	
equipment	1/7 of a chest x-ray using modern

Potential for Movement

Pesticides are transported through the environment as solids liquids and gases. Pesticides in the environment are absorbed, adsorbed, accumulated, degraded, diluted, inactivated and mobilized. Their ultimate fate is heavily influenced by the type of pesticide, the application rate, and environmental conditions at the time. The volatility, solubility, absorption and chemical activity characteristics of pesticides also affect movement. Electrochemical and absorption qualities of pesticides are important due to interaction with soil organic matter and clay particles. Solubility in water gives a preliminary indication of mobility. However, further study is required to determine degradation pathways and products. Extensive research has been conducted on most common pesticides to establish environmental pathways and final fate.

Water Quality Protection

Water quality is a major concern for FWP. Most FWP sites have both surface water and shallow groundwater. Soils are usually sandy and gravely with high infiltration and hydraulic conductivity rates. Some FWP sites have drainage paths, especially near boat ramps, which may transport chemicals to water.

2.32 LEGAL CONCERNS

Debate continues in the medical and biological communities over the human health and environmental effects of herbicides. Despite this indecision, the courts have continued to decide these same issues in the form of judgments and damage awards. Potential liability must be a consideration in any pesticide management plan. Manufacturers have attempted to reduce liability by producing less toxic, less persistent and more pest-specific pesticides. Landowners and applicators attempt to minimize liability by developing and following pest management plans which include personnel training, proper use and storage, public notification and other factors.

2.33 PESTICIDE STORAGE, HANDLING, USE AND DISPOSAL

The worst herbicide problems usually result from spills during storage, handling, use and disposal. When pesticides are applied to plants and soils they degrade relatively quickly and seldom penetrate deeply in soil. Most pesticides are broken down and adsorbed in the surface foot of soil. However, when large volumes of herbicides are spilled at one site, the capacity of the soil to degrade it is exceeded. This is a special concern at FWP properties due to proximity to surface and groundwaters and due to special concerns over fish and wildlife impacts.

Care must be exercised in handling and mixing chemicals. Equipment must be in good condition and inspected regularly. Drivers of vehicles must be especially vigilant since many spill are secondary to minor accidents. Chemicals should be mixed as needed in amounts that will be used entirely. Apply excess chemicals on suitable areas. Mix and rinse equipment at locations with acceptable collection and treatment or recycle collected mix back into the tank for mixing liquid. Other options may include rotating these activities on vegetated surfaces so excessive amounts do not percolate through the soil. Establish a spill response plan coordinated between appropriate departments and outside organizations.

not percolate through the soil. Establish a spill response plan coordinated between appropriate departments and outside organizations.

2.34 PESTICIDE LABELS

Pesticide labels are an important component of chemical pesticide use and safety. Labels are booklet format documents supplied with each container of product. The label contains detailed information to support four important goals of the regulation process for pesticide use including Identification, Protection of Health and the Environment, Special Practices and Legal Requirements. Pesticide labels have the force of law and should be an integral part of a weed management program. Appendix D details the components of pesticide labels and their use.

2.35 APPLICATOR LICENSES AND RECORDS

Applicators of restricted use pesticides, such as Tordon, must have a license from the state government. To obtain a license the applicator must take training courses and pass an exam for the specific type of pest problems that they will be treating. In order to retain that license the applicator must earn re-certification credits in government approved courses.

The law also requires that the applicator make and retain records of their use of pesticides. The application records must be submitted to the state department of agriculture on at least an annual basis. These records must be made available to state investigative officers at any time following a pesticide use complaint. All aspects of applicator licensing, re-certification training, and record keeping regulations administered by the state government are in-turn supervised by the United States Environmental Protection Agency.

2.4 INTEGRATED PEST MANAGEMENT

Integrated pest management (IPM) is a flexible combination of cultural, mechanical, biological and chemical control methods. The goal of most IPM programs for weeds is to meet vegetation goals while decreasing chemical use over time.

The success of IPM is dependent on the ability to monitor pest problems and to keep accurate records of outbreaks and the conditions that promote them, the treatments that are effective and costs or tradeoffs in their use.

ESTABLISH CONTROL STRATEGIES INDIVIDUAL WEEDS

ESTABLISH SITE PRIORITIES FOR TREATMENT

IDENTIFY WEED MANAGEMENT ZONES TO APPLY DIFFERENT PRESCRIPTIONS

SELECT CONTROL METHODS TO BE USED IN FWP REGION 5

COMPLETE SITE- SPECIFIC PLANS FOR ALL SITES BEFORE TREATMENT

3.0 PROPOSED MANAGEMENT ACTIONS

FWP Region 5 proposes to initiate a weed management plan emphasizing an Integrated Pest Management (IPM) approach. Weed management is a complex task and requires complex solutions with the flexibility to change as new information is gathered, new control methods become available and new weed problems arise. To address this complex issue, we have broken the task down into steps which add up to a comprehensive approach. Each of these steps can be adapted and improved upon independently as budgets and manpower allow.

STEP 1 - IDENTIFY A WEED CONTROL STRATEGY FOR EACH WEED. In this step we decide what to do with each weed (prevent, eradicate, reduce, contain or tolerate).

STEP 2 - SELECT WEED CONTROL METHODS.
In this step we select the tools we will use to control weeds emphasizing an integrated Pest Management approach and including cultural, mechanical, biological and chemical methods.

STEP 3 - IDENTIFY WEED MANAGEMENT ZONES.
In this step we divide up our sites into zones we will apply similar weed control treatments to.

STEP 4 - COMPLETE SITE-SPECIFIC WEED CONTROL PLANS.
In this step, site-specific plans are completed for all sites to inventory present conditions, identify TES species, delineate weed management zones, assess treatment priority and prescribe weed control.

STEP 5 - PRIORITIZE THE SITES FOR TREATMENT AND TREAT.
Since we operate under limited budgets, which sites shall receive weed control treatment first.

3.1 WEED CONTROL STRATEGIES

In this step each weed is assigned a control strategy mainly based on the physiological characteristics of the individual weed. Control strategies include: prevent, eradicate, reduce, contain and tolerate (USDA 1989). Control strategies depend on many factors including potential impact on FWP values, potential for spread and difficulty of control. These same factors are considered in listing weeds as noxious and so all noxious weeds are given high control priority. Definitions of the control strategy classes are as follows:

- **PREVENT** - Prevent the establishment of new noxious weed species through education, early detection, and transportation controls.
- **ERADICATE** - Attempt to eliminate noxious weeds from FWP sites. Eradication efforts will continue as long as the weed is present.
- **REDUCE** - Prevent seed production and reduce weed coverage. Prevent the weed from dominating other vegetation at the site but accept low levels infestations.
- **CONTAIN** - Prevent weed spread beyond the treatment or infestation area. Tolerate weeds within established infestations, but suppress or eradicate spread.
- **TOLERATE** - Accept established infestations that will likely spread to ecological limits. Eradicate new invasions where easy.

Proposed weed control strategies are presented in Table 5 for common local weed species. FWP will continue to evaluate the implications of weed control programs for wildlife, native plants and other concerns.

TABLE 5. WEED CONTROL STRATEGIES FOR REGION 5[1]

PREVENT - CLASS 1 - PRESENT A THREAT TO FWP PROPERTY

COMMON NAME	SCIENTIFIC NAME
Common crupina	Crupina vulgaris
Dyers woad	Isatis tinctoria
Eurasian water milfoil	Myriophyllum spicatum
Purple loosestrife	Lythrum salicaria
Rush skeletonweed	Chondrilla juncea
Yellow star-thistle	Centaurea solstitialis
Sulfur cinquefoil[2]	Potentilla recta
St. Johnswort	Hypericum Perforatum

ERADICATE/PREVENT - CLASS 2

Whitetop (Hoary cress)	Cardaria draba
Sulfur cinquefoil[2]	Potentilla recta

REDUCE/CONTAIN - CLASS 3

Canada thistle[2]	**Cirsium arvense**
Dalmation toadflax[2]	Linaria dalmatica
Diffuse knapweed	Centaurea diffusa
Leafy spurge[2]	**Euphorbia esula[3]** (eradicate new infestations)
Field bindweed[2]	Convolvulus arvensis
Spotted knapweed[2]	**Centaurea maculosa**
Russian knapweed	Centaurea repens

CONTAIN/REDUCE - CLASS 4

Bull thistle	**Circium vulgare[3]**
Broad-leaved plantain	Plantago major
Common dandelion	**Taraxacum officinale**
Common tansy	Tanacetum vulgare
Field pennycress	Thalaspi arvense
Houndstongue	Cynoglossum officinale
Lamb's-quarters	Chenopodium album
Mustards	Brassicaceae family
Pineapple weed	Matricaria matricarioides
Knotweed	Polygonum spp.
Purslane	Portulaca oleracea
Redroot Pigweed	Amaranthus retroflexus
Round-leaved mallow	Malva rotundifolia
Sheperd's purse	Capsella bursa-pastoris
Smartweed	Polygonum spp.

TOLERATE - CLASS 5

Cheatgrass	Bromus tectorum
Common timothy	Phleum pratense
Crested wheatgrass	Agropyron repens
Kentucky bluegrass	Poa pratensis
Quack grass	Agropyron repens
Other introduced grasses	

[1] Explanation of classes on following page
[2] Designated noxious weeds
[3] Bolded species were noted in the weed inventory

TABLE 5 (CONT.) - EXPLANATION OF CLASSES

PREVENT - Class 1 weeds are threatening FWP sites and occur on nearby lands. They have not been detected on FWP lands or only in very small numbers. It is possible to keep out infestations at this stage when only a few, small plants are present. Control efforts are very cost effective with this class. The weed control goal on these sites is to prevent the establishment of these weed species.

ERADICATE/PREVENT - Class 2 weeds occur in very small infestations and have the potential to spread rapidly. Control efforts are very cost effective with this class. The weed control goal on these sites is to prevent the establishment of these weed species and eradicate existing plants.

REDUCE/CONTAIN - Class 3 weeds are already abundant and have the greatest visual, economic and environmental impacts. These weeds occur across large acreages of Region 5 and widespread effective control is unlikely in the immediate future. The weed control goal on these sites is to contain and reduce populations when possible.

CONTAIN - Class 4 weeds are abundant on scattered sites in Region 5, are not regarded as being as serious a problem or present special control problems. The weed control goal on these sites is to contain and reduce populations when they occur in association with Class 3 weeds.

TOLERATE - Class 5 weeds are common on FWP sites and most are well-established non-native grasses which are not considered weeds by much of the general public. These species however compete with native species and may not provide habitat, cover and food sources equivalent to what they have replaced. These species may be tolerated while more traditional weed problems are addressed. A long-term goal will be to replacement these species with those native to FWP sites. The short-term goal will only include reseeding sites to native species which are disturbed by construction or other activities.

3.2 WEED CONTROL METHODS

Weed control in Region 5 would include cultural, mechanical, biological and chemical methods. The magnitude of the initial control attempt would require tremendous manpower and expense using cultural and mechanical methods. It is therefore expected that chemical control will be an important component of the IPM strategy in initial weed control efforts. After an initial chemical application, the goal of this program is to reduce chemical use and emphasize cultural and mechanical contol methods.

3.21 CULTURAL AND MECHANICAL

Cultural and mechanical weed control will continue to be a major part of the Region 5 program. On some sites, and especially where manpower is available, these methods may provide adequate weed control. Cultural and mechanical methods to be used in FWP Region 5 include:

- Prevention
- Revegetation
- Digging/ Hand-pulling
- Mowing/weed whipping
- Traffic Control
- User education

Since it is unlikely that FWP budgets will allow sufficient manpower to provide weed control in Management Zone 1 (Water Quality Protection MA), volunteer groups will be encouraged to assist the department. Sportsmen, students, church groups, scouts and others will be solicited for these projects.

3.22 BIOLOGICAL

FWP Region 5 will encourage continued developments of biological weed control agents in Montana. Region 5 will participate in releases of biological agents when possible and will cooperate with research projects by other organizations.

3.23 CHEMICAL

The herbicides picloram (Tordon), clopyralid (Stinger), glyphosate (Roundup) and imazapyr (Arsenal) will be used on FWP property in Region 5. These herbicides are some of the least toxic, persistent and mobile available. They may be used alone or in approved combinations. Appendix D contains chemical labels and material safety data sheets (MSDS) for each of these herbicides . Other herbicides, approved for use by the EPA and licensed for use in Montana, may be considered in the future. New chemicals proposed for use will be reviewed by FWP resource staff before approval. Appendix E contains chemical weed control guidelines for the most common weeds in Region 5.

Herbicides will be applied according to label directions, management zone goals, threatened, endangered and sensitive species concerns, and other site specific constraints required by this plan. Restricted-use chemical applications will be supervised by an applicator licensed in the State of Montana. This licensed applicator will be a FWP employee if applications are made by FWP. Contracted applications will also be supervised by a licensed contract applicator.

Site-specific plans will be developed for all proposed herbicide treatments as part of the treatment zone prescriptions. Herbicide use will depend on the treatment objective, season, weed species, weed growth stage, topography, expected cost, equipment limitations, and potential environmental impacts. Herbicide application rates will depend on weed species, weed density, non-target vegetation (especially TES species), soil type, management zone, wildlife, and presence of surface waters, wetlands, shallow groundwater or groundwater recharge zones.

Vehicle-mounted sprayers (hand guns, booms) will be used primarily along roadways and in off-road areas which are readily accessible by vehicle. Vehicle use will be restricted where soil or vegetation may be significantly disturbed. Examples of restrictive conditions include moist, compactible soil and steep slopes. Boom applicators will only be used where weeds are sufficiently concentrated. Hand gun application will be used for spot treatment of weeds in vehicle accessible areas. Under both hand gun and boom methods, chemicals will be applied in a manner that gives the best coverage with the least amount of drift.

Hand applications will be made with backpack sprayers and wiper applicators. Backpack sprayers will be used on small or scattered patches in rough terrain or environmentally sensitive areas. Contact systematic herbicides, such as glyphosate, will be used to treat individual plants and for seedbed preparation.

Precautions for use will include at a minimum:

- Herbicide applications will not be conducted when wind velocities exceed 10 mph.
- During application periods, weather conditions and temperature will be measured hourly by applicators.
- Calibration checks will be conducted at the beginning of the spraying season and periodically throughout to ensure that equipment is functioning correctly.
- Label requirements will be followed for all herbicide applications. Further precautions may be determined to be necessary during the pre-treatment reviews.
- All contract herbicide applications will be made by a licensed applicator.

The herbicide program will be evaluated annually as part of the overall weed monitoring and evaluation program.

3.3 WEED MANAGEMENT ZONES

Every small spot on earth is unique but it is difficult to manage each in a unique manner. Fortunately many have properties and treatment needs similar enough to allow grouping into weed management zones. These zones are distinguished according to the presence of surface water,

shallow groundwater, drainage to surface water, threatened/endangered/sensitive species, intense human use and other factors. These characteristics help define the weed control methods which can be used. Selected weed control methods are identified for each weed management zone. These weed management zones will be used to map all FWP sites in Region 5. All management zones will be in strict accordance with the environmental review criteria guidelines set forth in the Environmental Analysis Report (pp. 22-23).

3.31 WATER QUALITY PROTECTION MANAGEMENT ZONE (ZONE 1)

These sites include all open water bodies, wetlands, and areas of shallow groundwater where surface and groundwater contamination potential is high. Also included are buffer zones around water bodies sufficient to prevent contamination by chemical herbicides. Steep slopes, hard surfaces and drainage collection areas which direct runoff into open water area, are also included in this zone.

Weed control efforts in this management zone will be limited to cultural, mechanical and biological methods. Manual methods such as hand pulling, weed whipping, mowing and grubbing will be coordinated using volunteer and FWP labor.

3.32 SENSITIVE SPECIES MANAGEMENT ZONE (ZONE 2)

These zones have animal or plant populations that may be adversely affected by weed control efforts. Species requiring special consideration include those listed as rare, endangered, threatened or sensitive by the Montana Natural Heritage Program. Other special management zones may be identified by FWP.

Weed control efforts in this management zone will concentrate on cultural and mechanical methods however, biological methods will be considered if no potential adverse impacts are identified. Manual methods such as hand pulling and grubbing will be the major control method. More highly qualified or better trained laborers may be needed where sensitive species are difficult to identify.

3.33 HIGH INTENSITY HUMAN USE MANAGEMENT ZONE (ZONE 3)

These sites include picnic tables, tent sites, play areas, restrooms, interpretive sites and other locations where FWP visitors spend the most time and may come into the closest contact with applied herbicides.

Weed control in this management zone will emphasize chemical methods in the initial effort then mechanical and biological methods for the long term. Manual methods such as hand pulling, weed whipping, mowing and grubbing will be coordinated using volunteer and FWP labor. Biological control efforts will include cooperation in releases of biological agents. Chemical control will be considered on a site by site basis and will include a public notification program including newpaper anouncements and erection of signs at application sites. Chemical applications will be made on low-use days, not to include weekends or holidays. No chemical weed control will be used on sites where volunteer mechanical weed control efforts are successful.

3.34 GENERAL WEED MANAGEMENT ZONE (ZONE 4)

These sites include all areas not identified above including entrance roads, borrow and waste pits, parking lots and other sites.

Weed control efforts in this management zone will emphasize chemical control methods over the short term and mechanical, cultural and biological methods over the long term. Manual methods such as hand pulling, weed whipping, mowing and grubbing will be coordinated using volunteer and FWP labor. Biological control efforts will include cooperation in releases of biological agents. Chemical control will be considered on a site by site basis and will include a notification and signing program. No chemical weed control will be used on sites where volunteer mechanical weed control efforts are successful.

3.4 SITE SPECIFIC TREATMENT PLANS

This plan includes general information concerning site characteristics and weed distribution in FWP Region 5. Existing site information is sufficient to define the range of conditions encountered in Region 5 and to define broad management strategies. The existing weed inventory provides information on the most common weeds and is also sufficient to begin defining management strategies.

Despite current interest in weed management, and existing site and weed information, there is a need for more site specific information before final implementation. Additional site information needs include site-specific maps or sketches as well as soil, slope, drainage, groundwater or other information. Additional weed information includes updates on current conditions, new noxious and other weeds not considered in the 1985 inventory and other factors.

A site specific weed management inventory and plan will be completed for each FWP site before treatment. Appendix F illustrates an example form to be completed for each site. Considerations include weed distribution, potential for water contamination, and other factors.

3.5 SITE TREATMENT PRIORITIES

Budget, equipment and manpower limitations require prioritizing sites for weed control efforts. Weed control efforts will likely not be possible on all sites in all years. FWP sites will be prioritized based upon the following factors:

- Weed species.
- Control objectives.
- Stage of infestation.
- Potential for successful control.
- Acreage of weed infestation.
- Potential for spread on FWP property.
- Potential for spread beyond FWP property.
- Public concern over weeds or weed control efforts.
- Existing local weed management projects.
- Intensity of public use.
- Availability of volunteer labor.
- Budgets.
- Other factors.

3.6 OTHER SUBJECTS OF CONCERN

3.61 THREATENED, ENDANGERED AND SENSITIVE SPECIES CONCERNS

Regional land management agencies and conservation organizations have developed listings for threatened, endangered and sensitive (TES) plant and animal species. Some of these species fall under the criteria of the federal endangered species act. Most have been listed in Montana due to concerns about the relative small size of known populations. The goal of this weed management plan includes the preservation of TES species on FWP sites in Region 5.

Region 5 FWP sites occupy environmental conditions ranging from the aquatic zone and moist forest types to dry forest types and grasslands. Initial evaluations of the potential for TES species are usually based on their known distributions and habitats. These habitat surveys are used as the basis of field inventories to determine if TES species are present. Table 6 illustrates reported occurrences of TES species at or near FWP sites in Region 5 (Montana Natural Heritage Program).

TES species may include both plants and animals. A list of potential species should be compiled based on environmental and site conditions to use as an inventory guide.

TABLE 6. SENSITIVE PLANT OCCURRENCES ON DEPARTMENT FWP ACCESS SITES. All observations include sightings of sensitive plants found within one mile of the listed access sites. An asterisk (*) denotes an occurrence actually on the FWP sites. This information was obtained from the Montana Natural Heritage Program.

River	Site	Species
Stillwater	Buffalo Jump	Small Yellow Lady's Slipper (*Cypripedium Calceolus Var Parviflorum*)
Bluewater (Carbon County)	Bluewater	Rabbit Buckwheat (*Erigolum Lagopus*) Parrot-Head Indian Paintbrush (*Castelleja Longispica*) Giant Helleborine (*Epipactis Gigantea*) Joe-Pye Weed (*Eupatorium Maculatum Var Bruneri*)*
(Wheatland County)	Haymaker G.R.	Northern Rattlesnake Plantian (*Goodyera Repens*)

3.62 MONITORING AND RECORD KEEPING

A monitoring program will be used to document the effectiveness of weed management activities. Two to four sites will be selected each year where control efforts are planned. Data on weeds and other values will be collected before weed control treatment and annually for 1 - 2 years to evaluate effectiveness. At a minimum, photo points will be used to document effects. When possible, plots will be established, photographed, measured and re-measured to document target reductions in weed coverage and impacts on non-target species. Appendix G discusses monitoring methods for use in Region 5.

State pesticide use law and regulation requires that the applicator make and retain records of their use of pesticides. The application records must be submitted to the state department of agriculture on at least an annual basis. These records must be made available to state investigative officers at any time following a pesticide use complaint. All aspects of applicator licensing, re-certification training, and record keeping regulations administered by the state government are in-turn supervised by the United States Environmental Protection Agency. FWP will have responsibility for fulfilling these requirements when chemicals are applied by FWP personnel. Contractors will be responsible for filing in respect to contracted services and to provide FWP with copies of all reporting documents.

3.63 CONTRACTED SERVICES

Weed management activities, especially herbicide applications may be contracted when FWP personnel and equipment are not available. Contractors must be licensed and knowledgeable concerning the specific weeds to be treated and chemicals to be used. Contractors should be familiar with all components of this weed management plan especially those regarding safety and emergency response. Contractors must be provided with clear information including maps of zones to be treated.

Contractors must be supervised on a regular basis to insure compliance with contract specifications. Continuous supervision should be exercised in sensitive zones or in relation to expressed public concern.

At a minimum, contractors should keep detailed records concerning applications including the time and date of all applications, chemicals used, amounts, mixing notes (amount of chemical + amount of water), public contacts, weather and other pertinent information. This record-keeping requirement can be coordinated with other pesticide use reporting requirements.

3.64 NOTIFICATION

Public notification regarding weed management activities will be a continuing part of the FWP program. This program will include:

- Annual public notice through press releases to newspaper, radio and television sources concerning weed manage activities. Information may include chemical application schedules as well as other information on weeds and weed control activities such as notice of volunteer weed pulls. If media do not provide this information to the public, FWP will consider paid advertising.

- FWP will post highly visible signs prior to, during and immediately following chemical herbicide applications. Signs shall include the application date, chemical, principal target weeds, FWP contact for further information. Signs will be posted at the property entrance and near areas of concentrated human use. Sign posted will follow all manufactured safety warnings and EPA regulations.

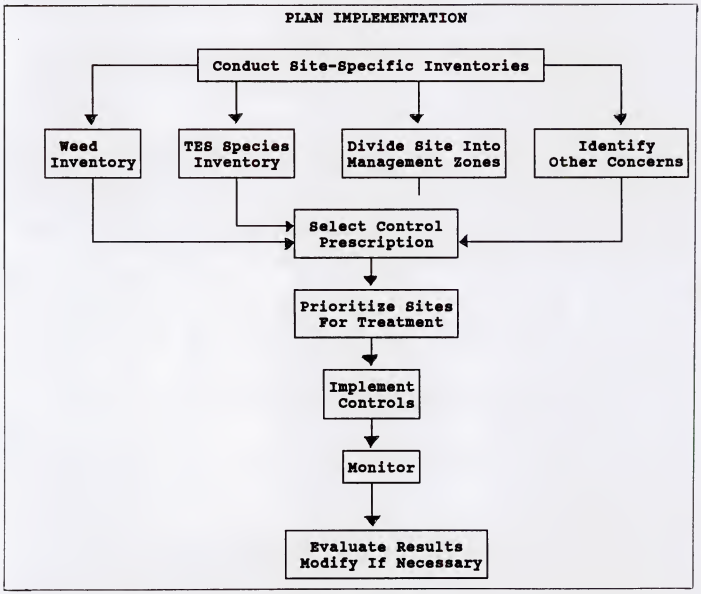
3.65 PESTICIDE SPILL EMERGENCY RESPONSE

Appendix H contains an emergency response plan for pesticide spill incidents. This plan should be carried with all applicators including both FWP and contract personnel. Contract requirements should include discussion of and adherence to these procedures in case of pesticide emergencies.

4.0 SUMMARY

This weed management plan establishes an Integrated Pest Management approach to controlling weeds in FWP Region 5. The plan provides weed control as required by state law and FWP policy while protecting important resources including water quality, aquatic and terrestrial habitat, species diversity and human health.

The progression of events to implementation this plan are as follows.



In 1994, a preliminary site priority list will be assembled for the highest priority sites based on historical data. Site specific inventories will be completed for these sites and control methods will be implemented in 1994. Site specific inventories will then be completed on the remaining sites, priorities assigned and control methods implemented.

5.0 REFERENCES

Hansen, P., S. Chaddee and R. Pfister. 1988. **Riparian Dominance Types of Montana.** Montana For. And Range Cons. Exper. Sta. U. Montana. Missoula, MT. 411p.

Land and Water Consulting. 1991. **Weed control monitoring plots.** Glacier National Park, Montana. 38p.

Land and Water Consulting Inc. 1992. **Pest Management Plan: The University of Montana.** Land and Water Consulting, Missoula, MT. 65p.

Montana Cooperative Extension Service. 1992. **Montana Weed Control Guide.** EB. 23.

Montana Heritage Program. 1993. Personal communication - **Threatened, Endangered and Sensitive Species Search** for FWP Region 5. Helena, MT.

Story, J. 1979. **Biological Weed Control in Montana.** Montana Ag. Exp. Sta. Bull. 717. Montana State Univ. Bozeman, MT. 15p.

USDA Animal and Plant Health Service. 1989. **Biological Control of Leafy Spurge.** Program Aid 1435. 11p.

USDA Forest Service. 1986. **Draft Environmental Impact Statement: Custer National Forest Noxious Weed Treatment Program.** Billings, MT.

USDA Forest Service. 1989. **Draft Environmental Impact Statement: Noxious Weed Management Plan.** Missoula, MT.

USDA Soil Conservation Service (SCS). 1981. **Average Annual Precipitation, Montana.**

USDI Bureau of Land Management (BLM). 1985. **Environmental Impact Statement of Northwest Area Noxious Weed Control Program.** Portland, OR.

USDI Bureau of Land Management (BLM). 1989. **EIS Vegetation Treatment of BLM Lands in Thirteen Western States.** Casper, WY.

Ware. G. W. 1980. **Complete Guide to Pest Control And Without Chemicals.** Thompson Publications, Fresno, CA.

Whitson, T. D. 1991. **Weeds of the West.** Pioneer Printers of Jackson Hole, Jackson, WY.

APPENDICES

APPENDIX A. MONTANA NOXIOUS WEED LIST

APPENDIX B. LAWS RELATED TO PESTICIDE USE

APPENDIX C. BIOLOGICAL WEED CONTROL AGENTS IN WESTERN MONTANA

APPENDIX D. PESTICIDE LABELS

APPENDIX E. MONTANA WEED CONTROL GUIDES

APPENDIX F. SITE SPECIFIC WEED MANAGEMENT INVENTORY/PRESCRIPTION

APPENDIX G. WEED CONTROL PROGRAM EFFECTIVENESS MONITORING

APPENDIX H. PESTICIDE EMERGENCY RESPONSE PLAN

APPENDIX I. TES SPECIES IDENTIFICATION

APPENDIX A. LIST OF MONTANA NOXIOUS WEEDS

Category 1

COMMON NAME	SCIENTIFIC NAME
Canada thistle	Cirsium arvense
Field bindweed	Convolvulus arvensis
Whitetop (Hoary cress)	Cardaria draba
Leafy spurge	Euphorbia esula
Spotted knapweed	Centaurea maculosa
Diffuse knapweed	Centaurea diffusa
Russian knapweed	Centaurea repens
Dalmation toadflax	Linaria dalmatica
St. Johnswort	Hypericum perforatum

Category 1 noxious weeds are weeds that are currently established in many counties of the state. Management criteria for control of these weeds is necessary in all counties to contain or suppress existing infestations or to prevent, through eradication or other appropriate measures, new infestation of these weeds. All of these weeds render land unfit or greatly limit the beneficial uses. (rule 4.5.202)

Category 2

Dyers woad	Isatis tinctoria
Purple loosestrife	Lythrum salicaria
Sulfur cinquefoil	Potentilla recta

Category 2 noxious weeds are weeds that have not been detected in the State of Montana or have recently been introduced in the State of Montana. These weeds have the potential for rapid spread and invasion of lands, thereby rendering them unfit for beneficial uses. County planning to prevent the spread or introduction of these weeds is necessary. Management criteria for detection and immediate action to eradicate or contain these weeds is necessary in all counties. (rule 4.5.203)

Category 3

Yellow star-thistle	Centaurea solstitialis
Common crupina	Crupina vulgaris
Rush skeletonweed	Chondrilla juncea

APPENDIX B. LAWS AND REGULATIONS RELATED TO WEED CONTROL IN MONTANA

State and federal laws, policies, and programs that will affect FWP Region 5 activities include:

- Creating a VISION for the Future of Montana's Department of Fish, Wildlife & Parks (1992)
- Weed Control Program for Lands Managed by the Montana Department of Fish, Wildlife and Parks (1983)
- Montana Pesticide Control Act (80-8-801 *et seq.*, MCA)
- Montana Weed Control Act (80-7-701 *et seq.*, MCA)
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). This law, administered by the Environmental Protection Agency, provides for the registration of pesticides, certification of applicators to apply restricted use pesticides and enforcement of pesticide regulations.
- Montana Noxious Weed Trust Fund Act of 1985 (80-7-801 *et seq.*, MCA) as amended 1991 and Rules
- Montana Water Quality Act (75-5-101 *et seq.*, MCA)
- Montana Agricultural Chemical Ground Water Protection Act of 1989 (80-15-100 *et seq.*, MCA)
- Montana Environmental Policy Act (MEPA, 75-1-101 *et esq.*, MCA)

APPENDIX C. BIOLOGICAL WEED CONTROL AGENTS IN MONTANA

HOST	CONTROL AGENT	ACTION
Knapweeds	Agapeta zoegana	root mining moth
	Chaetorellia acrolophi	seed head fly
	Cyphocleonus achates	root weevil
	Larinus minutus	seed head weevil
	Larinus obtusus	seed head beetle
Metzneria paucipunctella		moth feeds on flowerets and seeds
	Pelochrista medullana	root-mining moth
	Pterolonche inspersa	root moth
	Sclerotinia spp.	fungus
	Sphenoptera jugoslavica	root-mining beetle
	Subanguinia picridis	leaf gall nematode
	Terellia virens	seed head fly
	Urophora affinis	gallfly larvae attacks seed head
	U. quadrifasciata	
Leafy spurge	Aphthona cyparissiae	flea beetle larvae and adults attack
	Aphthona flava	flea beetle larvae and adults
	A. czwalinae	leaves, stems, and roots
	Bayeria spp.	midge causes shoot tip galls
	Hyles euphorbiae	hawk moth larvae defoliates
	Oberea erythrocephala	beetle larvae/adults attack stem root crown
	Spurgia esula	shoot-tip gall midge
St. Johnswort (goatweed)	Chrysolina quadrigemina	beetle defoliator
Musk thistle	Rhinocyllus conicus	weevil attacks the seed head
	Trichosiracalus horridus	weevil attacks rosettes
Canada thistle	Ceuorhynchus litura	stem mining weevil
	Uphora cardui	stem and shoot gallfly
Dalmation toadflax	Calophasia lunula	defoliating larvae/moth

APPENDIX D. PESTICIDE LABELS AND MATERIAL SAFETY DATA SHEETS (MSDS).

Pesticide labels are an important component of chemical pesticide use and safety. Labels are booklet format documents supplied with each container of product. The label contains detailed information to support four important goals of the regulation process for pesticide use including Identification, Warnings, Special Practices and Legal Requirements. Pesticide labels have the force of law and should be an integral part of a weed management program.

Identification
The active ingredients contents of the product are specified using standardized chemical terms and identification codes. The manufacturer is listed.

Protection Of Health And Environment.
Warnings and safety procedures are detailed for the protection of applicators, the general public, non-target organisms, and the environment. Health and safety warnings must be made using terms with specific meaning as to the degree of potential hazard. Safety procedures to minimize these hazards are listed. When useful for a specific pesticide product these safety procedures include such things as use of protective clothing, time period restrictions for re-entry to a sprayed area, prohibitions against mixtures that would produce adverse reactions. Known potential environmental hazards from the use of the specific product are stated in the label. For example, if the active ingredient has a high potential to be leached down through the soil and contaminate shallow groundwater this hazard is detailed
in a warning statement.

Specific Application Practices
The target organism for which the product is recommended are identified. Application rates and timing are detailed. The geographic areas and types of sites in which the product can be used are stated. Many products can only be used in certain states or counties, while their use may be expressly forbidden in other areas where that product can create an environmental hazard because of climatic or soil conditions.

Legal Requirements To Follow The Label
The label is a legal notification to the applicator. It has the force of law. The label states "It is a violation of Federal Law to use this product in a manner inconsistent with its labeling."

APPENDIX E. CHEMICAL WEED CONTROL GUIDELINES FOR MAJOR WEEDS ON REGION 5 FWP SITES (Montana Weed Control Guides, MSU Cooperative Extension Service, MSU, Bozeman, MT 1992)

KNAPWEED, DIFFUSE OR SPOTTED - continued

*** 2,4-D amine or ester** (Several trade names)

Rate: 2 lb ae/A.

Time: Apply in the rosette stage in fall or spring.

Remarks: Annual treatment necessary to control new seedlings.

Caution: Do not graze dairy animals on treated areas within 7 days of application.

LEAFY SPURGE

*** picloram** (Tordon)

Rate: 1 to 4 qt/A.

Time: Apply to actively growing spurge in spring or fall.

Remarks: Lower rates will require annual retreatment for several years. Retreat when control drops below 80%. Addition of 2,4-D may improve control at lower rates. Use 4 qt/A when treating small patches.

Caution: **A restricted-use herbicide.** Forage grasses may be injured on low organic matter or sandy textured soils at higher Tordon rates. Carefully read and observe all label restrictions.

Tank Mix: 1 to 2 pt/A of picloram + 1 lb ae/A of 2,4-D.

*** 2,4-D ester** (Several trade names)

Rate: 1 to 2 lb ae/A.

Time: Apply during early bud stage and in fall.

Remarks: Suppression only. Apply every year in both spring and fall for satisfactory control.

Caution: Do not graze dairy animals on treated areas within 7 days of application.

*** 2,4-D amine or ester** (Several trade names) - continued

Remarks: Suppression only. Better control is obtained if treated twice a year, in the bud stage in late spring and again in fall. Plan to treat for several consecutive years.

Caution: Do not graze dairy animals on treated areas within 7 days of application.

KNAPWEED, DIFFUSE OR SPOTTED

*** clopyralid** (Stinger)

Rate: 12 fl oz/A (pasture and rangeland).

12 fl oz/A (noncropland).

Time: Apply in the rosette stage (spring and fall) to midbolt stage (spring).

Remarks: Annual treatment necessary to control new seedlings.

Caution: Do not apply more than once per season.

Tank mix: 1/2 to 2 lb ae of 2,4-D (noncropland).

*** clopyralid + 2,4-D** (Curtail)

Rate: 2 qt/A (non-cropland)
2 to 4 qt/A (rangeland and pasture)

Time: Apply from rosette (spring or fall) to midbolt (spring).

Remarks: Annual treatment necessary to control new seedlings.

Caution: If within 2 weeks of application, remove meat animals from treated areas 7 days prior to slaughter.

*** dicamba** (Banvel)

Rate: 2 to 3 pt/A.

Time: Apply in rosette stage in fall or spring.

Remarks: Annual treatments necessary to control new seedlings.

Caution: Remove meat animals from treated areas 30 days prior to slaughter. Consult label for dairy animal grazing restrictions.

Tank Mix: 1 to 2 pt/A of Banvel + 1 to 2 lb ae/A of 2,4-D.

*** picloram** (Tordon)

Rate: 1 to 1 1/2 pt/A of 22K.

Time: Apply in fall or spring through June while actively growing. Optimum time is rosette to prebud.

Remarks: Provides residual control for 2 to 5 years depending upon soil type.

Caution: **A restricted-use herbicide.** Carefully read and observe all label restrictions.

DYERS WOAD

dicamba (Banvel)

Rate: 1 to 2 qt/A.

Time: Apply between bud and bloom stage and in fall.

Remarks: Annual applications are necessary to control new seedlings. Growth starts in early spring and flowering and seed production occur before most other plants. Use 1/2% surfactant for improved control.

Caution: Remove meat animals from treated areas 30 days prior to slaughter. Consult label for dairy animal grazing restrictions.

2,4-D amine or ester (Several trade names)

Rate: 1 to 1 1/2 lb ae/A.

Time: Apply at rosette stage, before 4 inches tall in spring.

Remarks: Annual applications are necessary to control new seedlings. Growth starts in early spring and flowering and seed production occur before most other plants. Addition of 1/2 pt/A of Banvel will increase the effectiveness of late applications.

Caution: Do not graze dairy animals on treated areas within 7 days of application.

FIELD BINDWEED

*** dicamba** (Banvel)

Rate: 1 to 2 qt/A.

Time: Apply during vigorous fall growth or in summer when plants are in or beyond the full bloom stage.

Remarks: Mid to late fall treatments have been most effective. Repeat applications are necessary for complete control. Rate depends on weed density, see label.

Caution: Banvel rates above 2 qts/A may cause temporary injury to forage grasses. Remove meat animals from treated areas 30 days prior to slaughter. Consult label for dairy animal grazing restrictions.

Tank Mix: 1 to 2 qt/A of Banvel + 1 to 2 lb ae/A of 2,4-D.

*** glyphosate** (Roundup)

Rate: 4 to 5 qt/A.

Or, 2% solution (spray to wet foliage).

Time: Apply late summer or fall when actively growing.

Remarks: For spot-treatment. Repeat applications are necessary for complete control.

Caution: All vegetation in treated area will be killed. Avoid drift. Do not graze or harvest forages for 2 weeks after application. Do not treat more than 1/10 of any one acre at one time.

*** picloram** (Tordon)

Rate: 1 to 2 qt/A of 22K.

Time: Apply in fall or spring when actively growing.

Remarks: Lower rates will require annual re-treatment for several years.

Caution: **A restricted-use herbicide.** Carefully read and observe all label restrictions.

Tank Mix: 1 qt/A of Tordon 22K + 1 lb ae/A of 2,4-D.

*** 2,4-D amine or ester** (Several trade names)

Rate: 1 to 2 lb ae/A.

Time: Apply between bud and bloom stage and in fall.

*** dicamba** (Banvel) - continued

Caution: Remove meat animals from treated areas 30 days prior to slaughter. Consult label for dairy animal grazing restrictions.

Tank Mix: 1 to 2 qt/A of Banvel + 1 lb ae/A qt of 2,4-D.

*** glyphosate** (Roundup)

Rate: 2 to 3 qt/A.
Or, 2% solution (spray to wet foliage).

Time: Apply when majority of thistles are at or beyond bud stage or in fall before a hard-killing frost.

Remarks: For spot-treatment. All vegetation in treated areas will be killed. Avoid drift.

Caution: Do not graze or harvest forage for 2 weeks after application. Do not treat more than 1/10 of any one acre at one time.

*** MCPA iso-ocytl ester** (Several trade names)

Rate: 3 lbs ae/A in sufficient water to provide thorough coverage.

Time: When weeds are in bud to early bloom.

Caution: Do not graze dairy animals on treated areas within 7 days of application.

*** picloram** (Tordon)

Rate: 1 to 2 qt/A 22K.

Time: Apply in the fall or spring when thistles are actively growing.

Caution: **A restricted-use herbicide.** Carefully read and observe all label restrictions.

Tank Mix: 1 qt/A of Tordon 22K + 1 lb ae/A of 2,4-D.

*** 2,4-D amine or ester** (Several trade names)

Rate: 1 to 2 lb ae/A.

Time: Apply when thistles are in bud stage and in fall.

Remarks: Suppression only. Better control is obtained if treated twice a year, in the bud stage in spring and again in fall. Plan to treat for several consecutive years.

Caution: Do not graze dairy animals on treated areas within 7 days of application.

DALMATION TOADFLAX

*** glyphosate** (Roundup)

Rate: 4 to 5 qt/A.

Or, a 2% solution (spray to wet foliage).

Time: Apply between bud and bloom stage or in fall while actively growing.

Remarks: For spot-treatment. Provides suppression only.

Caution: All vegetation in treated area will be killed. Avoid drift. Do not graze or harvest forages for 2 weeks after application. Do not treat more than 1/10 of any one acre at one time.

*** picloram** (Tordon)

Rate: 1 to 3 qt/A of 22K.

Time: In rosette stage in spring or fall.

Remarks: Suppression only. Repeat applications are necessary.

Caution: **A restricted-use herbicide.** Forage grasses may be injured on low organic matter or sandy textured soils at these Tordon rates. Consult Montana Special Local Need label. Carefully read and observe all label restrictions.

CANADA THISTLE

* clopyralid (Stinger)

Rate:	2/3 to 1 1/3 pt/A (pasture and rangeland)
	1/4 to 1/2 pt/A (noncropland)
Time:	Apply after a majority of basal leaves have emerged, but before bud stage.
Caution:	Do not apply more than once per season.
Tank Mix:	1/2 to 2 lb ae of 2,4-D (noncropland)

* dicamba (Banvel)

Rate:	1 to 2 qt/A
Time:	Apply to fall regrowth or when thistles are in the rosette stage and before a hard-killing frost or in bud stage.

APPENDIX E. CHEMICAL WEED CONTROL GUIDELINES FOR MAJOR WEEDS ON REGION 2 FWP SITES (Montana Weed Control Guides, MSU Cooperative Extension Service, MSU, Bozeman, MT 1992)

REGULATORY INFORMATION: (Not meant to be all-inclusive--selected regulations represented.)

NOTICE: The information herein is presented in good faith and believed to be accurate as the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numberous federal, state or provincial, and local laws and regulations. See MSD Sheet for health and safety information.

U.S. REGULATIONS

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard
A delayed health hazard

TOXIC SUBSTANCES CONTROL ACT (TSCA):

All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

OSHA HAZARD COMMUNICATION STANDARD:

(Continued On Page R-2)

REGULATORY INFORMATION (CONTINUED)

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

8. HANDLING PRECAUTIONS: (CONTINUED)

clothing impervious to this material. Selection of specific items such as gloves, boots, apron or full-body suit will depend on operation.

EYE PROTECTION: Use chemical goggles, safety glasses, or face shield when handling, depending on the type of handling operation.

9. ADDITIONAL INFORMATION:

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep out of reach of children. Avoid contact with skin and eyes. Provide eye fountain and washing facilities near work area. Do not ship or store with food, feeds, drugs or clothing. Do not contaminate irrigation or domestic water, food or feed by storage or disposal.

MSDS STATUS: Sections 6, 8 and regsheet Revised 7/92.

For information regarding state/provincial and federal regulations see the Regulatory Information Section.
(R) Indicates a Trademark of DowElanco

6. HEALTH HAZARD DATA:

EYE: May cause severe eye irritation. Corneal injury is unlikely. Effects likely to heal readily.

SKIN CONTACT: Prolonged or repeated exposure may cause skin irritation, even a burn.

SKIN ABSORPTION: A single prolonged skin exposure is not likely to result in absorption of harmful amounts. The LD50 for skin absorption in rabbits is >2000 mg/kg.

INGESTION: Single dose oral toxicity is extremely low. The oral LD50 for male and female rats is >5000 mg/kg. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; swallowing amounts larger than that may cause injury.

INHALATION: Single exposure to vapors is not likely to be hazardous.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Repeated excessive exposures to high amounts may cause liver effects.

CANCER INFORMATION: Did not cause cancer in long-term animal studies.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Even exposures having an adverse effect on the mother should have no effect on the fetus.

REPRODUCTIVE EFFECTS: No relevant information found.

MUTAGENICITY (EFFECTS ON GENETIC MATERIAL): The preponderance of data shows picloram to be non-mutagenic in 'in vitro' (test tube) tests and in test animals and is therefore believed to pose no mutagenic risk.

(Continued On Page 4)

7. FIRST AID:

EYES: Irrigate with flowing water immediately and continuously for fifteen minutes. Consult medical personnel.

SKIN: Wash off in flowing water or shower.

INGESTION: Induce vomiting if large amounts are ingested. Consult medical personnel.

INHALATION: Remove to fresh air if effects occur. Consult medical.

NOTE TO PHYSICIAN: If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

8. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE(S): Picloram: ACGIH TLV is 10 mg/m3; OSHA PEL is 10 mg/m3 total dust, 5 mg/m3 respirable. Dow IHG is 2 mg/m3 for polyglycol 26-2.

VENTILATION: Control airborne concentrations below the exposure guideline. Good general ventilation should be sufficient for most conditions.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required for certain operations, use an approved air-purifying respirator.

SKIN PROTECTION: For brief contact, no precautions other than clean body-covering clothing should be needed. When prolonged or frequently repeated contact could occur, use protective

(Continued On Page 5)

DowElanco

MATERIAL SAFETY DATA SHEET

DOWELANCO INDIANAPOLIS, IN 46268 EMERGENCY (517) • 636 • 4400

Product Code: 08505 Page: 1

Product Name: STINGER (R) HERBICIDE

Effective Date: 08/04/92 Date Printed: 02/11/93 MSDS:002805

1. INGREDIENTS: (% w/w, unless otherwise noted)

Active Ingredient:		40.9%
Clopyralid (3,6-dichloro-2-pyridinecarboxylic acid), Monoethanolamine salt	CAS# 057754-85-5	
Inert Ingredients:		59.1%
Water	CAS# 007732-18-5	
Isopropyl alcohol	CAS# 000067-63-0	
Proprietary surfactant		

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

2. PHYSICAL DATA:

BOILING POINT: 212F, 100C
VAP. PRESS: 23.5 mmHg @ 20C
VAP. DENSITY: 1.06 @ 20C
SOL. IN WATER: Infinite
SP. GRAVITY: 1.161 @ 68F, 20C
APPEARANCE: Dark brown clear liquid
ODOR: Sweet

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: 117F, 47.2C
METHOD USED: TCC

FLAMMABLE LIMITS
LFL: Not deter.

(Continued On Page 2)
(R) Indicates a Trademark of DowElanco

3. FIRE AND EXPLOSION HAZARD DATA: (CONTINUED)

UFL: Not deter.

EXTINGUISHING MEDIA: Water fog, alcohol resistant foam, CO2, dry chemical, foam preferred.

FIRE & EXPLOSION HAZARDS: Material is a water solution and except under gross fire conditions should not burn. Avoid contaminating water supplies with run-off water.

FIRE-FIGHTING EQUIPMENT: Under fire conditions use a positive pressure self-contained breathing apparatus and protective clothing.

4. REACTIVITY DATA:

STABILITY: (CONDITIONS TO AVOID) Store under cool, dry conditions. Avoid elevated temperatures and direct sunlight. Combustible: do not use or store near heat, open flame, or other sources of ignition, especially if temperatures are near or at the flash point.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Avoid acid, oxidizing material, halogenated organics, brass, copper, zinc, and aluminum.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen chloride, nitrogen oxides under fire conditions, chlorinated pyridine.

HAZARDOUS POLYMERIZATION: Will not occur.

(Continued On Page 3)

Wheat, Barley and Oats

Apply 1 4-1 3 pint of Stinger per acre from the 3 leaf stage up to early boot stage of growth. For control of perennial weeds such as Canada thistle, 1 3 pint of Stinger per acre should be used. Russian knapweed will only be suppressed at this rate.

Note: Do not permit dairy animals or meat animals being finished for slaughter to forage or graze treated grain fields within 1 week after treatment. Do not harvest hay from treated grain fields.

Tank Mixtures for Wheat, Barley and Oats

Tank mix 1 4 to 1 3 pint per acre of Stinger with the herbicides listed below for the control of additional weed

Active Ingredient	Product	Formulation	Amount of Product per Acre
bromoxynil	Buctril	2 lb gal	3/4-1 pt
chlorsulfuron	Glean	75% DF	1/6-1/4 wt oz
dicamba	Banvel	4 lb gal	1/8-1/4 pt
diuron	Direx 4L Diuron 4L Diuron 80 WDG Diuron DF	4 lb gal 80% DF 80% WP	3/4-1 1/4 pt 1 2-1 lb
MCPA or 2,4-D†		4 lb gal	1 2-1 qt
metribuzin†	Lexone DF Sencor DF	75% DG	2 1 2-4 wt oz
metsulfuron methyl†	Ally	60% DF	1/10 wt oz
terbutryn†	Igran 80WP	80% WP	7 5-12 5 wt oz
thifensulfuron†	Harmony	75% DF	1/3-1 2 wt oz
tribenuron methyl†	Express	75% DF	1/6-1/4 wt oz
thifensulfuron + tribenuron methyl†	Harmony Extra	75% DF	1/3-2/3 wt oz

†Tank mix for application on wheat and barley only.

Non-Cropland

For use on non-cropland areas such as fencerows, around farm buildings and equipment pathways. For control of broadleaf weeds, apply 1 4-1 1 3 pints of Stinger per acre. The lower rate of 1/4 pint per acre provides acceptable control of weeds only under highly favorable growing conditions and when plants are 1-3 inches tall. Apply 1/2 pint per acre when weeds are 3-6 inches tall or under dry conditions. Where Canada thistle or knapweeds are the primary pest, best results are obtained by applying 2/3-1 1/3 pints of Stinger per acre. To improve spectrum of activity or to increase activity against taller weeds, Stinger may be tank mixed with 0.5-2.0 lb ae per acre of 2,4-D amine or low volatile ester.

Rangeland and Permanent Grass Pastures

Use Stinger on forage grasses such as smooth brome, orchardgrass, and Timothy.

Apply 1 2-1 1 3 pints of Stinger per acre when weeds are young and actively growing. Grasses are tolerant, but new grass seedlings may be injured to varying degrees until the grass has become well established.

Note: Some forbs are susceptible to Stinger Herbicide. Do not spray pastures containing desirable forbs, especially legumes, unless injury can be tolerated. However, the stand and growth of established perennial grasses is usually improved after spraying, especially when rainfall is adequate and grazing is deferred.

Do not use hay or straw from treated areas for composting or mulching on susceptible broadleaf crops.

There are no grazing restrictions for Stinger at label use rates.

Conservation Reserve Program (CRP) For Seeding To Permanent Grasses Only

Do not use Stinger if legumes or bentgrass are a desired cover during CRP.

Conditions that stress grasses, such as drought, will increase potential for injury to the grass at all stages of growth. Do not use in newly seeded areas until grass is established.

After CRP, do not plant broadleaf crops in treated areas until an adequately sensitive bioassay shows that no detectable clopyralid is present in the soil.

Broadcast Applications (Ground)

Applications of Stinger should be made when perennial grasses have become established (has tillered, developed a good secondary root system and shows good vigor) since most perennial grasses have shown better tolerance to the herbicide at that stage.

For control of actively growing weeds such as musk thistle, Canada thistle, and knapweed (spotted, diffuse and Russian), use 2/3-1 1/3 pints per acre of Stinger after the majority of basal leaves have emerged, but before bud stage. For the control of wild buckwheat, volunteer sunflower and musk thistle rosettes, apply 2/3 pint per acre of Stinger. Stinger can also be tank mixed with 1/2-1 lb per acre of 2,4-D where species present are sensitive to 2,4-D. For best results, use in 10 or more gallons of water per acre by ground. Increasing the rate of application can increase the risk of injury. Application prior to the flowering stage is recommended (still in the bud stage).

WARRANTY DISCLAIMER

DowElanco warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. DOWELANCO MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY

INHERENT RISKS OF USE

It is impossible to eliminate all risks associated with use of this product. Plant injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application or other factors, all of which are beyond the control of DowElanco or the seller. All such risks shall be assumed by Buyer.

LIMITATION OF REMEDIES

The exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories), shall be limited to, at DowElanco's election, one of the following:

1. Refund of purchase price paid by buyer or user for product bought, or
2. Replacement of amount of product used.

DowElanco shall not be liable for losses or damages resulting from handling or use of this product unless DowElanco is promptly notified of such loss or damage in writing. In no case shall DowElanco be liable for consequential or incidental damages or losses.

The terms of the "Warranty Disclaimer" above and this "Limitation of Remedies" cannot be varied by any written or verbal statements or agreements. No employee or sales agent of DowElanco or the seller is authorized to vary or exceed the terms of the "Warranty Disclaimer" or this "Limitation of Remedies" in any manner.

DowElanco
Indianapolis, IN 46268, U.S.A.
*Trademark of DowElanco

Specimen Label 112-25-002 Date Code 292
EPA Approval 02/03/92 Replaces 112-25-001
Discard Previous Specimen Labels

REVISIONS INCLUDE:
1) Use of clopyralid in Scotch Pine deleted from Chirstmas Tree Section.
2) Added conversion of "pints to fluid ounces" table.
3) Wetlands statement under "Environmental Hazards" updated as per EPA policy.

Application

Timing

Apply to actively growing weeds. Extreme growing conditions such as drought or near freezing temperatures prior to, at, and following time of application may reduce weed control and increase the risk of crop injury at all stages of growth. Only weeds which are emerged at the time of application will be affected. Wet foliage at the time of application may decrease control. The treatment with Stinger will be rainfast within 6-8 hours after application.

Rate

Generally, lower labeled application rates will be satisfactory for young, succulent growth of sensitive weed species. For less sensitive species, perennials, and under conditions where control is more difficult (plant stress conditions such as drought or extreme temperatures, dense weed stands, and/or larger weeds), the higher rates will be needed. Weeds in fallow or other areas where crop competition is not a factor will generally require higher rates to obtain control or suppression.

Coverage

Adequate spray coverage and drift control are important. Obtaining a balance between spray coverage and drift control may sometimes be difficult but can be achieved provided the applicator understands the factors affecting coverage and drift. Factors affecting spray coverage include spray volume, crop canopy, and weed density. As crop canopy and weed density increase, spray volume should be increased to obtain equivalent weed control. Refer to manufacturer's recommendations for information on the relationship between gallons per acre spray pressure, sprayer speed, nozzle type and arrangement, nozzle height above the target canopy, droplet size, and drift potential for respective application equipment. Use equipment and nozzle types which are designed for herbicide application. Do not apply less than 2 and not more than 40 gallons per acre total spray volume. For best results, apply 10 or more gallons per acre by ground. Reducing total spray volume may result in decreased coverage and weed control. Use enough total spray volume and a delivery system to provide thorough coverage and a uniform spray pattern. Do not apply where spray drift may be a problem due to proximity of susceptible crops or other desirable plants.

Use of Adjuvants

Addition of surfactants, crop oils, or other adjuvants is not usually necessary when using Stinger. Adding a surfactant to the spray mixture may increase effectiveness on weeds but may reduce selectivity to the crop, particularly under conditions which promote plant stress. If an adjuvant is added to the spray solution, follow all manufacturer use guidelines.

Tank Mixes

When tank mixing, read and follow the label of each tank-mix product used for precautionary statements, directions for use, weeds controlled, and geographic and other restrictions. Use in accordance with the most restrictive of label limitations and precautions. No label dosages should be exceeded. This product cannot be mixed with any product containing a label prohibition against such mixing.

APPROVED USES

Sugar Beets

Stinger herbicide is recommended for the control of various annual and perennial broadleaf weeds infesting sugar beets. Apply 1/4 to 2/3 pint of Stinger per acre with ground equipment as a broadcast foliar spray. Apply in 10 or more gallons total spray volume per acre when the sugar beets are in the cotyledon to 8 leaf stage of growth and the weeds are young and actively growing. Re-treat as necessary but do not exceed 2/3 pint of Stinger per acre per season. Do not apply within 105 days before harvest of beet roots and tops.

Stinger Herbicide may be applied as a band treatment. Use the formulas below to determine the appropriate rate and volume per treated acre.

Band width in inches / Row width in inches	X	Broadcast rate per treated acre	=	Band rate per treated acre
Band width in inches / Row width in inches	X	Broadcast volume per treated acre	=	Band volume per treated acre

For annual weed control spray 1/4 – 1/2 pint of Stinger per acre on weeds up to the 5 leaf growth stage. Wild buckwheat applications should be made at the 1-3 leaf stage, before vining begins.

For the most effective control of perennials such as Canada thistle and sowthistle, apply 1/2 – 2/3 pint of Stinger per acre as a broadcast treatment to the entire infested area. Apply when the majority of broad leaves have emerged, but before the bud stage. Cultivation can disrupt translocation to the roots of perennials such as Canada thistle. For best results do not cultivate thistle patches.

To promote herbicide efficacy wait a minimum of 7 days after application before flood or furrow irrigation.

Tank Mixes

To control additional broadleaf weeds and provide consistent control of difficult weeds such as wild buckwheat, tank mix 1/4 – 2/3 pint of Stinger per acre with 2/3-6.5 pints of Betamix or Betanex. For best results, apply 1/4 pint of Stinger tank mixed with 2/3-6.5 pints of Betamix or Betanex followed 1-2 weeks later by a second application of 1/4 – 1/3 pint of Stinger per acre tank mixed with Betamix or Betanex. **Note:** Do not add additional adjuvants when employing a Betamix or Betanex tank mix with Stinger due to increased potential for crop injury. (See "Tank Mixes" section under "General Use Precautions".)

Stinger may be tank mixed with grass herbicides such as Poast for grassy weed control. Be sure to include crop oil or Dash surfactant to optimize grass weed control. (See "Tank Mixes" section under "General Use Precautions".)

Field Corn

Stinger is recommended for postemergence control of Canada thistle, Jerusalem artichoke, annual sowthistle, common sunflower, common cocklebur, giant and common ragweed, jimsonweed and other broadleaf weeds infesting field corn. Apply Stinger at suggested timing and rates for field corn as indicated below.

Apply Stinger to actively growing broadleaf weeds any time after corn emergence through 24 inch tall corn. Apply with ground equipment as a postemergence broadcast or directed spray in 10 or more gallons of spray volume per acre to ensure uniform and thorough spray coverage of the weed foliage. Use only spray nozzles designed for herbicide application. The use of flat fan nozzles provides the best coverage and distribution of chemical on the plant foliage. Use spray pressures (at the boom) which nozzle manufacturers recommend to obtain desired spray volume. Use higher spray pressures and volumes when weed foliage is dense.

For effective control of Canada thistle, apply 1/3-2/3 pint of Stinger per acre as a broadcast treatment to the entire infested area. Apply when the majority of thistle plants have emerged, and thistles are at least 6-8 inches in diameter or height, but before bud stage. Cultivation can disrupt translocation to the roots of Canada thistle. For best long term control, do not cultivate before or after application. If cultivation is necessary, wait 14 to 20 days after application before cultivating to allow for thorough translocation.

Control of Canada thistle will be influenced by growing conditions, density and size of thistle plant at the time of application, tillage practices used, etc. Light infestations (less

than 10 plants per square yard) will generally be adequately controlled with a rate of 1 3 pint per acre. For medium to heavy infestations, (more than 10 plants per square yard) rates of 1-2-2 3 pint per acre are generally more effective since these Canada thistle stands involve an extensive rhizome system.

The following are general descriptions of control to be expected from each rate of application, given a medium to heavy population of Canada thistle. Control of lighter infestations may be better than that described.

A rate of 1 3 pint per acre will suppress top growth of Canada thistle for 6-8 weeks. Some regrowth may occur by the end of the season, but this will not interfere with harvesting of the crop.

A rate of 1 2 pint per acre will generally provide season long control of Canada thistle. Not all rhizomes will be killed, and some regrowth may occur by the end of the growing season.

A rate of 2 3 pint per acre will provide season long control of Canada thistle plus suppression into the following season, resulting in a reduction of the total number of Canada thistle plants in the treated area.
For control of common cocklebur, giant ragweed, common ragweed, sunflower, other annual weeds and Jerusalem artichoke, apply 1 4-1 2 pint of Stinger on weeds up to the 5 leaf stage. Use higher rate listed for heavy infestations or when greater residual control is desired.

Corn Inbred Lines or Breeding Stock

Susceptibility of corn to injury from Stinger is highly related to varietal response. Inbred lines or any breeding stock may be injured by Stinger. Contact your seed production agronomist for advice before applying Stinger to inbred lines or breeding stock.

Hand-Held Sprayers
Applications should be made on a spray-to-wet basis with spray coverage uniform and complete. Do not spray to the point of runoff. Prepare the desired volume of spray solution by mixing the amount of Stinger with water as shown in the following table.

Desired Volume Spray Solution	Amount of Stinger
1 gal	1/4 fl oz
25 gal	1/3 pt
100 gal	1 1/3 pt

Restrictions: Re-treat as necessary, but do not apply more than 2/3 pint of Stinger per acre per year. Do not apply to field corn greater than 24 inches tall. Do not allow livestock to graze treated areas or harvest treated corn silage as feed within 40 days after last treatment.

Christmas Tree Plantations

Timing
Stinger can be safely applied over the top of actively growing: balsam fir, blue spruce, Douglas fir, Fraser fir, grand fir, lodgepole pine, noble fir, ponderosa pine, and white pine. For the Pacific Northwest: do not apply in the first year of transplanting. (Some needle curling has been observed on 1st year transplants.) Apply to actively growing weeds. For control of annual weeds apply Stinger up to the 5 leaf growth stage (for wild buckwheat application at 3-5 leaf, but before vining, is recommended). For control of weeds such as Canada thistle and knapweeds, apply after the majority of the basal leaves have emerged, but before bud stage. Later application may result in less consistent control.

Rate
Apply 1/4-1/2 pint of Stinger per acre for control of annual weeds. Apply 1.2-2.3 pint of Stinger per acre for difficult to control weeds such as Canada thistle and knapweeds. Apply as a broadcast or band application in a minimum of 10 gallons per acre by ground application. For band applications, use the formula under "sugar beets" to determine the appropriate rate and volume per treated acre. Apply as often as needed, but do not exceed 2/3 pint per acre. Do not exceed 1 2 pint per acre for blue spruce. Tree injury may occur with the addition of a surfactant or crop oil with Stinger. Do not use unless previous experience shows injury is tolerable.

Grasses Grown For Seed

Timing
Apply only to established grasses before the boot stage. Applications in the boot stage and beyond can result in increased injury. Do not apply to bentgrass unless injury can be tolerated. For control of late emerging Canada thistle, a preharvest treatment may be made after grass seed is fully developed. Treatment of Canada thistle at the bud stage or later may result in less consistent control. Post harvest fall treatments may be made to actively growing Canada thistle after the majority of basal leaves have emerged.

Rate
Use 1/4 to 2/3 pint of Stinger per acre for control of annual weeds and Canada thistle. Re-treat as necessary, but do not exceed 2/3 pint of Stinger per acre per season.

Tank Mixtures for Grasses Grown for Seed
Stinger may be tank mixed with 2,4-D, MCPA, dicamba, or bromoxynil to control additional broadleaf weeds. Refer to the manufacturer's label for use rates and tank mix guidelines.

Note: Dicamba or bromoxynil tank mixes may be useful in broadening the annual weed control spectrum, but may reduce long term control of perennials such as Canada thistle. Do not tank mix Stinger with 2,4-D, MCPA, or dicamba unless the risk to crop injury is acceptable.

Fallow Cropland

Timing
Stinger can be applied either postharvest, in the spring/summer (during fallow period), or to set-aside acres to control or suppress weeds listed above (refer to rotation restrictions). Apply to young, emerged weeds under conditions that promote active growth. For best results on perennial weeds such as Canada thistle, apply after the majority of the basal leaves have emerged, but before bud stages. Later applications may result in less consistent control. Extreme growing conditions (such as drought or near freezing temperatures) prior to, at, and following the time of application may reduce weed control.

For best results, wait 14 to 20 days after application before cultivating or fertilizing with shank-type applicators to allow for thorough translocation.

Rate
Apply 1/4-2/3 pint of Stinger per acre. Use the higher rate on perennial weeds or when the condition of the weeds at the time of treatment may prevent optimum control.

Tank Mixtures for Fallow Cropland
To improve control of certain broadleaf weeds, Stinger may be applied with 0.5-2.0 lb ae per acre 2,4-D.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling

Read all "DIRECTIONS FOR USE" carefully before applying.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

Storage: Store above 28° F or warm to 40° F and agitate before use.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Metal Container Disposal: Do not reuse container. Triple rinse (or equivalent). Puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Plastic Container Disposal: Do not reuse container. Triple rinse (or equivalent). Puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Sprayer Clean-Out: To avoid injury to desirable plants, equipment used to apply Stinger should be thoroughly cleaned before reusing to apply any other chemicals.

1. Rinse and flush application equipment thoroughly after use at least three times with water, and dispose of rinse water in non-cropland area away from water supplies.
2. During the second rinse, add 1 qt of household ammonia for every 25 gallons of water. Circulate the solution through the entire system so that all internal surfaces are contacted (15-20 min). Let the solution stand for several hours, preferably overnight.
3. Flush the solution out of the spray tank through the boom.
4. Rinse the system twice with clean water, recirculating and draining each time.
5. Nozzles and screens should be removed and cleaned separately.

GENERAL INFORMATION

Stinger herbicide is recommended for selective, postemergence control of broadleaf weeds in sugar beets, field corn, wheat, barley and oats not underseeded with a legume, fallow cropland, rangeland and permanent grass pastures, grasses grown for seed, Christmas trees, conservation reserve program (CRP) acres, and non-cropland areas including fence rows, around farm buildings, and equipment pathways.

GENERAL USE PRECAUTIONS

Apply only once per 12 month period, except for Christmas trees, sugar beets, field corn and grasses grown for seed. A fallow treatment that precedes or follows a small grain application is also allowed, except in irrigated small grains.

Rotation Crop Restrictions

Residues of Stinger in treated plant tissues which have not completely decayed may affect succeeding susceptible crops.

- Wheat, barley, oats, grasses, field corn, or sugar beets may be planted at anytime following treatment.
- Do not plant alfalfa, asparagus, canola (rapeseed), cole crops, grain sorghum, onions, popcorn, safflower, sweet corn, or strawberries for 12 months after a Stinger herbicide application.
- Do not plant dry beans, soybeans, or sunflowers for 12 months after a Stinger herbicide application, or 18 months if soils contain less than 2% organic matter and natural precipitation is less than 15 inches during the 12 months following treatment. For these areas see "Special Conditions" section.
- Do not plant other crops, including peas, lentils, potatoes and broadleaf crops grown for seed for 18 months after treatment unless the risk of injury is acceptable. For low moisture (less than 15 inches annual rainfall) and low organic matter (less than 2%) areas, a field bioassay is recommended prior to planting these sensitive crops.

Special Conditions: In areas defined previously as low in organic matter and precipitation, sensitive crops such as dry beans, soybeans, and sunflowers may be injured when planted 12 months after treatment. Unless the risk of injury is acceptable, these crops should not be planted until 18 months after treatment. The potential for injury may be reduced by burning, removal, or incorporation of treated crop residues with a minimum of 2 supplemental fall irrigations.

This product can affect susceptible broadleaf plants directly through foliage and indirectly by root uptake from treated soil. Therefore, do not apply Stinger directly to or allow spray drift to come in contact with vegetables, flowers, grapes, tomatoes, potatoes, beans, lentils, peas, alfalfa, sunflowers, soybeans, safflower, or other desirable broadleaf crops and ornamental plants or soil where these sensitive crops will be planted the same season.

Do not contaminate irrigation ditches or water used for irrigation or domestic purposes.

Avoid spray drift: Applications should be made to avoid spray drift since very small quantities of the spray, which may not be visible, may severely injure susceptible crops during both growing and dormant periods. Use coarse sprays to minimize drift since, under adverse weather conditions, fine spray droplets may drift a mile or more. A drift control or deposition agent such as Nalco-Trol may be used with this product to aid in reducing spray drift. If used, follow all use recommendations and precautions on the product label.

To minimize spray drift, apply Stinger in a total spray volume of 10 or more gallons per acre as large-droplet, low-pressure spray. Refer to manufacturer's recommendations for additional information on gallons per acre, spray pressure, sprayer speed, nozzle types and arrangements, nozzle heights above the target canopy, etc., for respective application equipment. Spot treatments should only be applied with a calibrated boom to prevent misapplication. With ground equipment, spray drift can be lessened by keeping the spray boom as low as possible; by applying no more than 20 gallons of spray per acre; by using no more than 30 pounds spraying pressure with large droplet-producing nozzle tips; by spraying when wind velocity is low; and by stopping all spraying when wind exceeds 6 to 7 miles per hour. Do not apply with hollow cone-type insecticide or other nozzles that produce a fine-droplet spray.

Do not apply by aircraft.

Do not transfer livestock from treated grazing areas onto sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated pasture. Otherwise, urine may contain enough clopyralid to cause injury to sensitive broadleaf plants.

Do not move treated soil and avoid situations where treated soil particles may blow into area where susceptible crops are grown. Violent windstorms may move soil particles. If this product is on soil particles and they are blown onto susceptible plants, visible symptoms may appear. Serious injury is unlikely. The hazard of movement of this product on dust is reduced if treated fields are irrigated or if rain occurs shortly after application.

Straw from treated areas, or manure from animals that have grazed treated areas, cannot be used for composting or mulching on ground where susceptible crops may be grown the following season. To promote herbicide decomposition, plant material should be evenly incorporated or burned. Adequate moisture is also required to promote breakdown of plant residues which contain clopyralid.

Do not use in a greenhouse. Excessive amounts of this herbicide in the soil may temporarily inhibit seed germination or plant growth.

Broadleaf Weeds Controlled

artichoke, Jerusalem
buckwheat, wild
buffalobur†
burdock, common
chamomile, false (scentless)
chamomile, mayweed (dogfennel)
clover, sweet
clover, red
cocklebur, common
coffeeweed
cornflower (bachelor button)
dandelion
dock, curly
groundsel, common
hawksbeard, narrowleaf
horseweed
jimsonweed
knapweed, diffuse
knapweed, Russian†
knapweed, spotted
ladysthumb†
lettuce, prickly
locoweed, white
locoweed, Lambert
marshelder
nightshade, Eastern black
nightshade, cutleaf
nightshade, hairy
oxeye daisy
pineappleweed
ragweed, common
ragweed, giant
salsify, meadow (goatsbeard)
sickleood
smartweed, green†
sorrel, red
sowthistle, annual
sowthistle, perennial†
starthistle, yellow
sunflower
thistle, Canada
thistle, musk
vetch
volunteer alfalfa
volunteer beans
volunteer lentils
volunteer peas

†These weeds may only be suppressed. Suppression is a visual reduction in weed competition (reduced population or vigor) as compared to untreated areas. The degree of weed control and duration of effect will vary with weed size and density, spray rate and coverage, and growing conditions before, during, and after the time of treatment. For perennial weeds, Stinger will control the initial top growth and inhibit regrowth during the season of application (season-long control). At higher use rates shown on this label, Stinger may cause a reduction in shoot regrowth in the season following application. However, plant response may be inconsistent due to inherent variability in shoot regrowth from perennial root systems.

Weed Control Guidelines† Amount of Stinger Per Acre x Use Site††

Weed Species	Growth Stage	Sugar Beet, Christmas Trees	Wheat, Barley, Oats	Grasses for Seed	Fallow Cropland	Range & Pasture, CRP, & Non-crop	Field Corn
clover cocklebur sunflower ragweeds Jerusalem artichoke jimsonweed volunteer soybean vetch marshelder	Up to 5 leaf	1.4-1.2 pt	1.4-1.3 pt	1.4-1.2 pt	1.4-1.2 pt	1.3-2.3 pt	1.4-1.2 pt
wild buckwheat nightshade sp. buffalobur smartweeds (suppression)	1-3 leaf stage, but before vining 2-4 leaf 2-3 leaf	1.2 pt					
Canada thistle sowthistle (suppression) knapweeds, spotted diffuse knapweeds, Russian (suppression)	rosette to preboud up to bud stage	1.2 -2.3 pt 2.3 pt	1.4-1.3 pt ---	1.3-2.3 pt 2.3 pt	2.3 pt —	2.3-1 pt 2.3-1pt 1- 1.1 3 pt	1.3-2.3 pt — ----

† This table is intended as a reference only. For complete instructions see the body of the text.
†† Use the lower rate for light to moderate infestations and good growing conditions and the higher rate for dense infestations or under poor growing conditions such as drought.

For measuring small volumes, refer to the following table to obtain appropriate conversions of pints to fluid ounces.

Conversion Chart - Pints to Fluid Ounces

Pints	Fluid Ounces
1/3	5
1/4	4
1/2	8
2/3	11

VINE CROPS

Kiwi Fruit*

Grapes:* Any variety of table, wine, or raisin grape may be treated with any equipment listed in this section.

In the northeast and Great Lakes regions, applications must be made prior to the end of bloom stage of grapes to avoid injury.

*Applications should not be made when green shoots, canes, or foliage are in the spray zone.

*Allow a minimum of 14 days between last application and harvest.

CALIFORNIA

This product has been approved by the U.S. Environmental Protection Agency and by the state of California for the uses, crops and sites listed in this label. With the exception of these items, this booklet contains the material approved by California.

These use conditions, crops and sites may not be treated with this product in California until approval is received:

- Cool season turf growth regulation.
- Escort tank mixtures.

This product has been approved for use in California except as stated otherwise on page 121.

EPA Reg. No. 524-445 898.07-000.01/CG

In case of an emergency involving this product,
Call Collect, day or night, (314) 694-4000.

MONSANTO COMPANY
AGRICULTURAL PRODUCTS
ST. LOUIS, MISSOURI, 63167 U.S.A.

Specimen Label

DowElanco

Stinger*

Herbicide

For selective postemergence control of broadleaf weeds in sugar beets, field corn, wheat, barley, and oats not underseeded with a legume, Christmas tree plantations, grasses grown for seed, fallow cropland, rangeland and permanent grass pastures, non-cropland areas, conservation reserve program (CRP) acres

Active Ingredient:
clopyralid: 3,6-dichloro-2-pyridinecarboxylic acid, monoethanolamine salt 40.9%
Inert Ingredients.....59.1%
TOTAL.....100.0%
Acid Equivalent:
clopyralid: 3,6-dichloro-2-pyridinecarboxylic acid - 31% – 3 lb/gal
EPA Reg. No. 62719-73
EPA Est. 464-MI-1
Net Contents 1 qt

Precautionary Statements

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUSCION:

PRECAUSCION AL USUARIO:
Si usted no lee ingles, no use este producto hasta que la etiqueta le haya sido explicada ampliaments.

Hazards to Humans and Domestic Animals

Causes Eye Injury • Harmful If Inhaled Or Absorbed Through Skin. Avoid contact with eyes, skin or clothing. Avoid breathing spray mist. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

First Aid

If in eyes: Flush with plenty of water. Get medical attention if irritation persists.
If on skin: Wash with plenty of soap and water. Get medical attention.

Environmental Hazards

Do not contaminate water when disposing of equipment washwaters. Do not contaminate water used for irrigation or domestic purposes. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark.

Clopyralid is a chemical which can travel (seep or leach) through soil and under certain conditions contaminate ground- water which may be used for irrigation or drinking purposes. Users are advised not to apply clopyralid where soils have a rapid to very rapid permeability throughout the profile (such as loamy sand to sand) and the water table of an underlying aquifer is shallow, or to soils containing sinkholes over limestone bedrock, severely fractured surfaces, and substrates which would allow direct introduction into an aquifer. Your local agricultural agencies can provide further information on the type of soil in your area and the location of groundwater.

Physical or Chemical Hazards

Combustible - Do not use or store near heat or open flame. Do not cut or weld container.

Notice: Read the entire label. Use only according to label directions.

Before buying or using this product, read Warranty Disclaimer and Limitation of Remedies sections elsewhere on this label.
In case of an emergency endangering life or property involving this product, call collect 517-636-4400
Agricultural Chemical: Do Not Ship or Store with Food, Feeds, Drugs, or Clothing

Stinger*

NOTE

Repeat treatments may be necessary to control weeds originating from underground parts of untreated weeds or from seeds. This product does not provide residual weed control. For subsequent weed control, use repeated applications of this product. Do not apply more than 10.6 quarts of this product per acre per year.

EXTREME CARE MUST BE EXERCISED TO AVOID CONTACT OF HERBICIDE SOLUTION, SPRAY, DRIFT, OR MIST WITH FOLIAGE OR GREEN BARK OF TRUNK, BRANCHES, SUCKERS, FRUIT, OR OTHER PARTS OF TREES OR VINES. CONTACT OF THIS PRODUCT WITH OTHER THAN MATURED BROWN BARK CAN RESULT IN SERIOUS CROP DAMAGE.

AVOID PAINTING OUT STUMPS WITH THIS PRODUCT AS INJURY RESULTING FROM ROOT GRAFTING MAY OCCUR IN ADJACENT TREES.

Reduced control may result when applications are made to annual or perennial weeds that have been mowed, grazed or cut and have not been allowed to regrow to the recommended stage for treatment.

For specific rates of applications and instructions, see the "Weeds Controlled" section of this label, and to specific recommendations which follow.

MIDDLES MANAGEMENT

FOR ANNUAL WEEDS IN MIDDLES BETWEEN ROWS OF TREE AND VINE CROPS

For citrus crops treat uniformly between trees.

■ ROUNDUP® ■
■ ROUNDUP plus GOAL™ ■

This product alone or in mixtures with Goal will control or suppress the annual weeds listed below.

Apply the recommended rates of this product, either alone or in mixtures with Goal, plus 0.5 to 1 percent nonionic surfactant by spray volume in 3 to 10 gallons of water per acre. Apply when weeds are actively growing and less than 6 inches in height or diameter. If weeds are under drought stress, irrigate prior to application. Reduced control may occur if weeds have been mowed prior to application. Up to 48 fluid ounces per acre of this product may be used to control weeds which have been mowed, are stressed, or are growing in dense populations.

WEED SPECIES	MAXIMUM HEIGHT/ DIAMETER (INCHES)	RATE PER ACRE ROUNDUP® (FLUID OUNCES)	RATE PER ACRE GOAL (FLUID OUNCES)
Barley *Hordeum vulgare* **Bluegrass, annual** *Poa annua*	6	8	●
Barnyardgrass *Echinochloa crus-galli* **Chickweed, common** *Stellaria media* **Red Maids** *Calandrinia ciliata*	6	12	●
Crabgrass *Digitaria spp.* **Fleabane, flaxleaf** *Conyza bonariensis* **Groundsel, common** *Senecio vulgaris* **Ivyleaf** *Echinochloa colonum*	6	16 OR 16 to 32 + 4 to 16**	●
Lambsquarters, common *Chenopodium album* **Pigweed, redroot** *Amaranthus retroflexus* **Rocket, London** *Sisymbrium iro* **Ryegrass, common** *Lolium multiflorum* **Shepherdspurse** *Capsella bursa-pastoris* **Sowthistle, annual** *Sonchus oleraceus*	6	16 OR 16 to 32 + 4 to 16**	●
Cheeseweed, common *Malva spp.*	3	12 to 32 + 4 to 16	
Cheeseweed, common *Malva spp.* **Filaree*** *Erodium spp.* **Horseweed/Marestail** *Conyza canadensis* **Nettle, stinging** *Urtica dioica* **Purslane, common** *Portulaca oleracea*	6	16 to 32 + 4 to 16	

*Suppression only.

**The mixture of this product plus Goal is recommended when weeds are stressed or growing in dense populations.

STRIPS

FOR ANNUAL AND PERENNIAL WEEDS IN STRIPS OF TREE AND VINE CROPS

■ TANK MIXTURES WITH RESIDUAL HERBICIDES ■

When applied as a tank mixture, this product provides control of the emerged annual weeds and control or suppression of emerged perennial weeds listed in this label.

The following residual herbicides will provide preemergence control of those weeds listed in the individual product labels.

■ ROUNDUP® plus GOAL™ 1.6E ■
■ ROUNDUP plus KARMEX™ DF ■
■ ROUNDUP plus KROVAR™ I ■
■ ROUNDUP plus KROVAR™ II ■
■ ROUNDUP plus SIMAZINE, PRINCEP CALIBER™ 90 ■
■ ROUNDUP plus SIMAZINE 4L ■
■ ROUNDUP plus SIMAZINE 80W ■
■ ROUNDUP plus SOLICAM™ 80DF ■
■ ROUNDUP plus SURFLAN™ AS ■
■ ROUNDUP plus SURFLAN 75W ■
■ ROUNDUP plus SIMAZINE (80W, or 4L, or PRINCEP CALIBER 90) plus SURFLAN (AS or 75W) ■
■ ROUNDUP plus GOAL (1.6E) plus SURFLAN (AS or 75W) ■
■ ROUNDUP plus GOAL (1.6E) plus SIMAZINE (80W, or 4L, or PRINCEP CALIBER 90) ■
■ ROUNDUP plus GOAL (1.6E) plus SURFLAN (AS or 75W) plus SIMAZINE (80W, 4L, or PRINCEP CALIBER 90) ■

Do not apply these tank mixtures in Puerto Rico. When tank-mixing with residual herbicides, add an agriculturally approved nonionic surfactant at 0.5 to 1 percent by volume of spray solution.

Refer to the individual product labels for specific crops, rates, geographical restrictions and precautionary statements.

Read and carefully observe the label claims, cautionary statements, rates and all other information on the labels of all products.

™Karmex is a trademark of E.I. duPont de Nemours and Company.

RECOMMENDED RATES

Annual Weeds—Apply 1 to 5 quarts per acre of this product in these tank mixtures. Use rates at the higher end of the recommended range when weeds are stressed, growing in dense populations or are greater than 12 inches tall.

Perennial Weeds—Apply 1 pint to 5 quarts per acre of this product in these tank mixtures to control or suppress perennial weeds. Follow the recommendations in the "Weeds Controlled" section of this label for stage of growth and application rates for specific perennial weeds.

■ ROUNDUP® plus GOAL plus SIMAZINE/SURFLAN ■

This product plus low rates of Goal in three-way or four-way mixtures with simazine and/or Surflan will provide postemergence control of the weeds listed below.

Refer to the individual simazine and Surflan labels for preemergence rates, weeds controlled, precautionary statements and other important information.

Apply these tank mixtures in 3 to 40 gallons of water. Add 0.5 to 1 percent nonionic surfactant by total spray volume to the spray solution.

Apply 1 to 5 quarts per acre of this product plus 4 to 48 fluid ounces per acre of Goal plus labeled rates of simazine and/or Surflan to control the following weeds:

Barley, wild *Hordeum leporinum*	**Horseweed/Marestail** *Conyza canadensis*
Bluegrass, annual *Poa annua*	**Nettle, stinging** *Urtica dioica*
Cheeseweed, common *Malva spp.*	**Pineappleweed** *Matricaria matricarioides*
Chickweed, common *Stellaria media*	**Rocket, London** *Sisymbrium iro*
Filaree* *Erodium spp.*	**Shepherdspurse** *Capsella bursa-pastoris*
Fleabane, flaxleaf *Conyza bonariensis*	**Sowthistle, annual** *Sonchus oleraceus*
Groundsel, common *Senecio vulgaris*	

*Use a minimum of 1.5 quarts of this product in these mixtures.

NOTE: This recommendation does not preclude the use of Goal in these mixtures at higher, labeled rates for preemergence weed control.

■ PERENNIAL GRASS SUPPRESSION ORCHARD FLOORS ■

When applied as directed, this product will suppress vegetative growth as indicated below.

Bahiagrass

This product will provide significant inhibition of seedhead emergence and will suppress vegetative growth for a period of approximately 45 days with a single application and approximately 120 days with sequential applications. Apply this product 1 to 2 weeks after full green-up or after mowing to a uniform height of 3 to 4 inches. Applications must be made prior to seedhead emergence. Apply 6 fluid ounces of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 10 to 25 gallons of water per acre.

Sequential applications of this product plus nonionic surfactant may be made at approximately 45-day intervals to extend the period of seedhead and vegetative growth suppression. For continued seedhead suppression, sequential applications must be made prior to seedhead emergence. Apply no more than 2 sequential applications per year. As a first sequential application, apply 4 fluid ounces of this product plus nonionic surfactant. A second sequential application of 2 to 4 fluid ounces may be made approximately 45 days after the last application.

Bermudagrass

For burndown, apply 1 to 2 quarts of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 20 gallons of water per acre. Use 1 quart of this product in 3 to 20 gallons of water per acre east of the Rocky Mountains. Use 1 to 2 quarts of this product in 3 to 10 gallons of water per acre west of the Rocky Mountains. Use this treatment only if reduction of the bermudagrass stand can be tolerated. When burndown is required prior to harvest, allow at least 21 days to ensure sufficient time for burndown to occur.

Suppression only (east of the Rocky Mountains)—Apply 6 to 16 fluid ounces of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 20 gallons of water per acre no sooner than 1 to 2 weeks after full green-up. Mowing prior to application may occur provided a minimum height of 3 inches is maintained. Rates of 6 to 10 fluid ounces of this product plus nonionic surfactant should be used in shaded conditions or where a lesser degree of suppression is desired. Sequential applications may be made when regrowth occurs and bermudagrass injury and stand reduction can be tolerated.

Suppression only (west of the Rocky Mountains)—Apply 16 fluid ounces of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre up to 6 inches in height and no sooner than 1 to 2 weeks after full green-up. Mowing prior to application may occur provided a minimum height of 3 inches is maintained. Sequential applications may be made when regrowth occurs and bermudagrass injury and stand reduction can be tolerated.

Cool Season Grass Covers

For suppression of tall fescue, fine fescue, orchardgrass and quackgrass, apply 8 fluid ounces of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 10 to 20 gallons of water per acre. For best suppression, add ammonium sulfate to the spray solution at a rate of 2 percent by weight or 17 pounds per 100 gallons of spray solution.

For suppression of Kentucky bluegrass covers, apply 6 fluid ounces of this product plus 0.5 to 1 percent nonionic surfactant. Do not add ammonium sulfate.

For best results, mow cool-season grass covers in the spring to even their height and apply the recommended rate of this product 3 to 4 days after mowing. Avoid treating cool season grass covers under poor growing conditions, such as drought stress (drip irrigation), disease or insect damage.

LOW VOLUME APPLICATION (FLORIDA AND TEXAS)

For burndown or control of the weeds listed, apply the recommended rates of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 30 gallons of water per acre. Where weed foliage is dense, use 10 to 30 gallons of water per acre.

Annual Weeds

Goatweed—Apply 2 to 3 quarts per acre of this product plus 17 pounds of ammonium sulfate per 100 gallons of water plus 0.5 to 1 percent nonionic surfactant by total spray volume. Apply in 20 to 30 gallons of water per acre when plants are actively growing. Use 2 quarts per acre when plants are less than 8 inches tall and 3 quarts per acre when plants are greater than 8 inches. If goatweed is greater than 8 inches, the addition of Krovar II or Karmex may improve control. Use labeled rates for these residual products.

Read and carefully observe the label claims, cautionary statements, rates and all other information on the Krovar II and Karmex labels.

Perennial Weeds

Apply when weeds are actively growing and at the growth stages listed in the "Perennial Weeds Controlled" section of this label. If perennial weeds are mowed, allow weeds to regrow to the recommended stage of growth.

S = Suppression B = Burndown
PC = Partial control C = Control

WEED SPECIES	ROUNDUP RATE PER ACRE			
	1 qt	2 qts	3 qts	5 qts
Bermudagrass	B	•	PC	C
Guineagrass				
Texas and Florida Ridge	B	C	C	C
Florida Flatwoods	•	B	C	C
Paragrass	B	C	C	C
Torpedograss	S	•	PC	C

TREE CROPS

Citrus*: citron, grapefruit, kumquat, lemon, lime, orange pummelo, tangelo, tangerine, tangors.

Nuts**: almond, chestnuts, filbert, macadamia, pecan pistachio, walnut.

Pome Fruit*: apple, pear.

Stone Fruit**: apricots, cherries, nectarines, olives peaches, plums/prunes.

For cherries, any application equipment listed in this section may be used in all states.

For citron and olives, apply as a directed spray only.

Any application equipment listed in this section may be used in apricots, nectarines, peaches, and plums/prunes growing in Arizona, California, Colorado, Idaho, Kansas, Kentucky, New Jersey, North Dakota, Oklahoma, Oregon, Texas, Utah, and Washington, except for peaches grown in the states specified in the following paragraph. In all other states use wiper equipment only.

For PEACHES grown in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee only, apply with a shielded boom sprayer or shielded wiper applicator which prevents any contact of this product with the foliage or bark of trees. Apply no later than 90 days after first bloom. Applications made after this time may result in severe damage. Remove suckers and low hanging limbs at least 10 days prior to application. Avoid applications near trees with recent pruning wounds or other mechanical injury. Apply only near trees which have been planted in the orchard for 2 or more years. EXTREME CARE MUST BE TAKEN TO ENSURE NO PART OF THE PEACH TREE IS CONTACTED.

Tropical Fruit: acerola, atemoya*, avocado, banana (plantains), breadfruit*, canistel*, carambola*, coffee****, dates*, figs*, guava, jaboticaba*, jackfruit*, longan*, lychee*, mango*, papaya, passion fruit*, persimmons*, sapodilla, sapote, soursop, sugar apple*, tamarind*, tea. Allow a minimum of 1 day between last application and harvest of guava and papaya. In coffee and banana, delay applications 3 months after transplanting to allow the new coffee or banana plant to become established.

NOTE:

*Allow a minimum of 14 days between last application and harvest.

**Allow a minimum of 21 days between last application and harvest of these crops.

***Allow a minimum of 17 days between last application and harvest.

****Allow a minimum of 28 days between last application and harvest.

FALLOW AND REDUCED TILLAGE SYSTEMS

FOR AERIAL APPLICATION IN CALIFORNIA, REFER TO SUPPLEMENTAL LABEL.

Use this product in fallow and reduced tillage systems for control of annual weeds prior to emergence of crops listed in this label. Refer to the "Weeds Controlled" section of this label for specific rates and instructions. This product may be applied using ground or aerial spray equipment. See the "Application Equipment and Techniques" section of this label for instructions.

TANK MIXTURES

- **ROUNDUP® plus BANVEL plus NONIONIC SURFACTANT**
- **ROUNDUP plus 2,4-D plus NONIONIC SURFACTANT**
- **ROUNDUP plus GOAL™ plus NONIONIC SURFACTANT**

DO NOT APPLY BANVEL OR 2,4-D TANK MIXTURES BY AIR IN CALIFORNIA.

Applications of 2,4-D or Banvel must be made at least 7 days prior to planting corn. Applications of 2,4-D must be made at least 30 days prior to planting soybeans.

The addition of Banvel in a mixture with this product may provide short-term residual control of selected weed species. Some crop injury may occur if Banvel is applied within 45 days of planting. Refer to the Banvel and 2,4-D labels for cropping restrictions and other use instructions.

Roundup plus Goal Tank Mixtures

This product alone or in tank mixtures with Goal plus 0.5 to 1 percent nonionic surfactant by total spray volume will provide control of those weeds listed below.

Make applications when weeds are actively growing and at the recommended stages of growth. Avoid spraying when weeds are subject to moisture stress, when dust is on the foliage or when straw canopy covers the weeds.

ROUNDUP 12 fluid oz/acre		ROUNDUP 16 fluid oz/acre
Wheat	18"*	Annual grasses at
Barley	12"	least plus:
Bluegrass, annual	6"	Ryegrass, annual 6"
Barnyardgrass	6"	Chickweed 6"
Rye	6"	Groundsel 6"
		Marestail 6"
		Rocket, London 6"
		Shepherdspurse 6"
		Crabgrass 12"
		Johnsongrass, seedling 12"
		Lambsquarters 12"
		Oats, wild 12"
		Pigweed, redroot 12"
		Mustards 12"

ROUNDUP 12 fluid oz/acre + GOAL** 2 to 4 fluid oz/acre		ROUNDUP 16 fluid oz/acre + GOAL** 2 to 4 fluid oz/acre	
Annual grasses above plus:		Annual weeds above plus	
Cheeseweed, common	3"	Cheeseweed, common	6"
Chickweed	3"	Groundsel	6"
Groundsel	3"	Chickweed	12"
Rocket, London	6"	Rocket, London	12"
Shepherdspurse	6"	Shepherdspurse	12"

*Maximum height or length in inches.

**Use the higher rate when weeds approach maximum recommended height or stands are dense.

These recommended tank mixtures may be applied using ground or aerial spray equipment. Refer to the "Weeds Controlled" section of this label for specific rates and instructions.

™Goal is a trademark of Rohm and Haas Company.

ECOFARMING SYSTEMS

The recommendations made in this section are not registered for use in California.

The Ecofarming System consists of the following rotation: winter wheat, corn/sorghum, ecofallow.

Use the following tank mixtures for control of emerged annual weeds before planting corn or sorghum in the Ecofarming System.

ROUNDUP® at 16 to 20 fluid ounces per acre plus
2,4-D at 0.375 to 0.5 pound a.i. per acre plus
ATRAZINE at 0.75 to 1 pound a.i. per acre plus
LASSO® at 2.5 to 3 quarts per acre

The above tank mixture should be applied in 28-0-0 or 32-0-0 liquid fertilizer carrier at 20 to 30 gallons per acre. The liquid fertilizer may be diluted with water to achieve the required carrier volume.

WEEDS CONTROLLED—The following weeds, up to a maximum height of 4 inches, will be controlled:

Brome, downy *Bromus tectorum*
Cheat *Bromus secalinus*
Foxtail, green *Setaria viridis*
Foxtail, yellow *Setaria lutescens*
Kochia* *Kochia scoparia*
Lettuce, prickly *Lactuca serriola*
Pigweed, redroot *Amaranthus retroflexus*
Thistle, Russian *Salsola kali*
Wheat, volunteer *Triticum aestivum*

*For improved control of kochia, add 4 fluid ounces per acre (0.125 pound a.i. per acre) of Banvel to the above tank mixture.

Risk of crop injury from 2,4-D or Banvel can be reduced by applying this treatment 7 to 14 days before planting.

Refer to the label booklet for Lasso herbicide for pre-emergence weed control achieved by this tank mixture.

Refer to the specific product labels for crop rotation restrictions and cautionary statements for all products used in these tank mixtures.

®Lasso is a registered trademark of Monsanto Company.

AID TO TILLAGE

This product, when used in conjunction with preplant tillage practices, will provide control of downy brome, cheat, volunteer wheat, tansy mustard and foxtail. Apply 8 fluid ounces of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. Make applications when weeds are actively growing and before they are 6 inches in height. Application must be followed by conventional tillage practices no later than 15 days after treatment and before regrowth occurs. Allow at least 1 day after application before tillage. Tank mixtures with residual herbicides may result in reduced performance.

PASTURES

Apply this product prior to planting forage grasses and legumes.

Pasture or Hay Crop Renovation—When applied as a broadcast spray, this product controls the annual and perennial weeds listed in this label prior to planting forage grasses or legumes. Remove domestic livestock before application and wait 8 weeks after application before grazing or harvesting.

Spot Treatment—When applied as a spot treatment as recommended, this product controls annual and perennial weeds listed in this label which are growing in pastures, forage grasses and forage legumes composed of bahiagrass, bermudagrass, bluegrass, brome, fescue, orchardgrass, ryegrass, timothy, wheatgrass, alfalfa or clover.

Wiper Application—When applied as directed, this product controls or suppresses the weeds listed under "Wiper Applicators" in the "Selective Equipment" section of this label.

For spot treatment and wiper application, apply in areas where the movement of domestic livestock can be controlled. No more than one-tenth of any acre should be treated at one time. Further applications may be made in the same area at 30 day intervals. Remove domestic livestock before application and wait 14 days after application before grazing livestock or harvesting.

SUGARCANE

When applied as directed for "Cropping Systems", under the conditions described, this product controls those emerged annual and perennial weeds listed on this label growing in or around sugarcane or in fields to be planted to sugarcane. This product will also control undesirable sugarcane.

NOTE: Where repeat treatments are necessary, do not exceed a total of 10.6 quarts of this product per acre per year. Do not apply to vegetation in or around ditches, canals or ponds containing water to be used for irrigation.

Broadcast Treatment—Apply this product in 10 to 40 gallons of water per acre on emerged weeds growing in fields to be planted to sugarcane.

For specific rates of application and instructions for control of various annual and perennial weeds, see the "Weeds Controlled" section of this label.

For removal of last stubble or ratoon cane, apply 4 to 5 quarts of this product in 10 to 40 gallons of water per acre to new growth having at least 7 or more new leaves. Allow 7 or more days after application before tillage.

Spot Treatment in or Around Sugarcane Fields—For dilution and rates of application using hand-held equipment, see "Mixing, Additives and Application Instructions" and "Weeds Controlled" sections of this label.

For control of volunteer or diseased sugarcane, make a 1 percent solution of this product in water and spray to wet the foliage of vegetation to be controlled.

NOTE: When spraying volunteer or diseased sugarcane, the plants should have at least 7 new leaves.

Avoid spray contact with healthy cane plants since severe damage or destruction may result.

Do not feed or graze treated sugarcane forage following application.

CONSERVATION TILLAGE, MINIMUM TILLAGE AND NO-TILL SYSTEMS CORN AND SOYBEANS Tank Mixtures

The recommendations made in this section are not registered for use in California.

When applied as recommended under the conditions described, the tank mixtures listed in this section control many emerged weeds, and give preemergence control of many annual weeds where corn or soybeans will be planted directly into a cover crop, established sod, or in previous crop residues.

Refer to specific product labels for crop rotation restrictions and cautionary statements of all products used in these tank mixtures. For mixing instructions, see the "Mixing, Additives and Application Instructions" section of this label.

Apply these tank mixtures in 10 to 20 gallons of water or 10 to 60 gallons of nitrogen solution per acre before, during or after planting. Do not apply these mixtures after crop emergence.

When tank mixing with residual herbicides, add an agriculturally approved nonionic surfactant at 0.5 to 1 percent by volume of spray solution. The addition of 1 to 2 percent dry ammonium sulfate by weight may increase the performance of this product.

NOTE: When using these tank mixtures, do not exceed 4 quarts of this product per acre.

CORN

For residual control, this product may be tank-mixed with the following herbicides or combination of herbicides:

LASSO®/ALACHLOR	ATRAZINE
LARIAT®	CYANAZINE
BULLET®	SIMAZINE
OUAL™	PROWL™
BICEP™	

For improved burndown, this product may be tank-mixed with 2,4-D or dicamba. Applications of 2,4-D or dicamba must be made at least 7 days prior to planting corn. See the "Weeds Controlled" section for specific rate information.

SOYBEANS

For residual control, this product may be tank-mixed with the following herbicides or combination of herbicides:

CANOPY™	LOROX™ PLUS
COMMAND™	PREVIEW™
OUAL™	PROWL™
GEMINI™	TURBO™
LASSO®/ALACHLOR	SCEPTER™
LEXONE™	SENCOR™
LINURON	SQUAORON™

For improved burndown, this product may be tank-mixed with the following herbicides:

2,4-DB
2,4-D*

*Applications of 2,4-D must be made at least 30 days prior to planting soybeans. See the "Weeds Controlled" section for specific rate information.

CORN AND SOYBEANS

Annual Weeds—For difficult to control weeds such as fall panicum, barnyardgrass, crabgrass, shattercane and broadleaf signalgrass up to 2 inches tall, and Pennsylvania smartweed up to 6 inches tall, apply this product at 2 pints per acre in these tank mixtures. For other labeled annual weeds, apply 1 to 1.5 pints of this product per acre when weeds are less than 6 inches tall, and 2 to 3 pints when weeds are over 6 inches tall. For a complete list of annual weeds controlled, see the "Weeds Controlled" section of this label.

Perennial Weeds—At normal application times in minimum tillage systems, perennial weeds may not be at the proper stage of growth for control. See the "Weeds Controlled" section of this label for the proper stage of growth for perennial weeds.

Use of 2 to 4 quarts of this product per acre in the tank mixtures mentioned above, under these conditions provides top kill and reduces competition from many emerged perennial grass and broadleaf weeds. For emerged perennial weeds controlled, see the "Weeds Controlled" section of this label.

To obtain the desired stage of growth, it may be necessary to apply this product alone in the late summer or fall and then follow with a label-approved, seedling weed control program at planting.

USE OF THESE TANK MIXTURES FOR BERMUOAGRASS OR JOHNSONGRASS CONTROL IN MINIMUM TILLAGE SYSTEMS IS NOT RECOMMENDEO. For bermudagrass control, follow the instructions under "Control of Perennial Weeds" section of this label and then use a label-approved, seedling weed-control program in a minimum tillage or conventional tillage system. For johnsongrass control, follow instructions under "Control of Perennial Weeds" section of this label, and then use a label-approved seedling weed-control program with conventional tillage.

®Bullet, Lasso and Lariat are registered trademarks of Monsanto Company.

™Canopy, Blades, Gemini, Lexone, Lorox Plus and Preview are trademarks of E.I. duPont de Nemours and Company.

™Oual is a trademark of Ciba-Geigy Corporation.

™Sencor and Turbo are trademarks of Bayer AG.

™Prowl, Sceptor and Squadron are trademarks of American Cyanamid Company.

™Command is a trademark of FMC Corporation.

PREHARVEST APPLICATIONS

COTTON

When applied as directed under the conditions described, this product controls annual and perennial weeds listed on this label prior to the harvest of cotton.

Broadcast Applications—This product may be applied using either aerial or ground spray equipment. For ground applications with broadcast equipment, apply this product in 10 to 20 gallons of water per acre. For aerial applications, apply this product in 3 to 10 gallons water per acre.

FOR AERIAL APPLICATIONS, REFER TO THE "APPLICATION EQUIPMENT AND TECHNIQUES" AND "AERIAL EQUIPMENT" SECTIONS OF THIS LABEL.

FOR AERIAL APPLICATIONS IN CALIFORNIA, REFER TO THE FEDERAL SUPPLEMENTAL LABEL FOR AERIAL APPLICATIONS IN THAT STATE FOR SPECIFIC INSTRUCTIONS, RESTRICTIONS AND REQUIREMENTS.

DO NOT EXCEED A MAXIMUM RATE OF 1 QUART PER ACRE OF THIS PRODUCT WHEN MAKING APPLICATION BY AIR.

Weed Control—For specific rates of application and instructions for control of various annual and perennial weeds, for this product used alone or in the following tank mixtures, see the "Weeds Controlled" section of this label.

To control johnsongrass using multiple-directed or broadcast over-the-top-spray equipment, apply 1 quart of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 10 to 20 gallons of water per acre. Ensure complete coverage.

For partial control of field bindweed, apply 1 quart of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 20 gallons of water per acre. Apply when bindweed is actively growing and 12 inches or greater in length. Reduced performance may result if bindweed is under drought stress.

Tank Mixtures

ROUNDUP® plus DEF™ 6
ROUNDUP plus FOLEX™
ROUNDUP plus PREP™
ROUNDUP plus PREP plus DEF 6 or [illegible]

When applied as recommended under the conditions described, these tank mixtures control annual and perennial weeds listed on this label prior to the harvest of cotton. For application guidelines, precautions and use rates, refer to the DEF, Folex and Prep labels.

This product when tank-mixed with DEF 6 or Folex defoliants may provide enhancement of cotton leaf drop and regrowth inhibition.

Timing of Application—Apply this product or these tank mixtures for preharvest weed control after 60 percent of the cotton bolls have opened.

NOTE: DO NOT APPLY TO CROPS GROWN FOR SEED. Allow a minimum of 7 days between application and harvest. Do not feed or graze treated cotton forage or hay following preharvest applications.

™DEF is a trademark of Mobay Chemical Corporation.

™Folex and Prep are trademarks of Rhone-Poulenc, Inc.

TREE AND VINE CROPS

This product is recommended for weed control in established groves, vineyards, or orchards, or for site preparation prior to transplanting crops listed in this section. Applications may be made with boom equipment, CO2 shielded sprayers, hand-held and high-volume wand lances, or orchard guns, or with wiper applicator equipment, except as directed in this section. See "Application Equipment and Techniques" section of this label for specific information on use of equipment.

When applying this product, refer to the "Weeds Controlled" section of this label and to specific recommendations in this section for rates to be used.

WEED SPECIES	ROUNDUP (FL. OZ/A) + OUST (OZ/A)	8 + ¾	12 + ¾	12 + ½	16 + ¾	16 + ½	12 + 1	16 + 1
Geranium, Carolina *Geranium carolinianum*		•	S	S	C	C	C	C
Henbit *Lamium amplexicaule*		•	S	C	C	C	C	C
Ryegrass, Italian *Lolium multiflorum*		•	S	S	C	C	C	C
Speedwell, corn *Veronica arvensis*		S	C	C	C	C	C	C
Vetch, common *Vicia sativa*		C	C	C	C	C	C	C

*These rates or mixtures of rates apply only to sites where an established competitive turf is present.

RELEASE OF ACTIVELY GROWING BERMUDAGRASS

When applied as directed, this product will aid in the release of bermudagrass by providing control of annual species listed in the "Weeds Controlled" section of this and the Oust label, and suppression or partial control of certain perennial weeds.

For control or suppression of those annual species listed on this label, use 1 to 3 pints of this product as a broadcast spray in 10 to 25 gallons of spray solution per acre. Use the lower rate when treating annual weeds below 6 inches in height (or length of runner in annual vines). Use the higher rate as plant size increases or as they approach flower or seedhead formation.

Use the higher rate of this product for partial control of the following perennial species. Use the lower rates for suppression of growth. For best results, see the "Weeds Controlled" section of this label for proper stage of growth.

Bahiagrass *Paspalum notatum*	**Johnsongrass**** *Sorghum halepense*
Bluestem, silver *Andropogon saccharoides*	**Trumpetcreeper*** *Campsis radicans*
Fescue, tall *Festuca arundinacea*	**Vaseygrass** *Paspalum urvillei*

*Suppression at higher rates only.

**Control at the higher rates.

This product may be tank-mixed with Oust. If tank-mixed, use no more than 1 to 2 pints per acre of this product with 1 to 2 ounces of Oust per acre.

Use the lower rates of both mixtures to control annual weeds below 6 inches in height (or runner length in annual vines) that are listed in the "Weeds Controlled" section of this booklet and the Oust label. Use the higher rates as annual weeds increase in size and approach the flower or seedhead stages.

Use the higher rates of this product to provide partial control of the following perennial weeds. Use the lower rates for suppression of growth.

Bahiagrass *Paspalum notatum*	**Johnsongrass*** *Sorghum halepense*
Bluestem, silver *Andropogon saccharoides*	**Poorjoe**** *Diodia teres*
Broomsedge *Andropogon virginicus*	**Trumpetcreeper*** *Campsis radicans*
Dock, curly *Rumex crispus*	**Vaseygrass** *Paspalum urvillei*
Dogfennel *Eupatorium capilliforium*	**Verbena, blue** *Verbena hastata*
Fescue, tall *Festuca arundinacea*	

*Suppression at higher rates only.

**Control at the higher rates.

Use only on well-established bermudagrass. Bermudagrass injury may result from the treatment but regrowth will occur under moist conditions. Repeat applications in the same season are not recommended, since severe injury may result.

Read and carefully observe the cautionary statements and all other information appearing on the labels of all herbicides used.

COOL SEASON TURF GROWTH REGULATION

When applied as directed, this product will suppress growth and seedhead development of listed turf species in industrial sites.

This product is recommended for management of coarse turfs on roadside rights-of-way or other industrial areas. Do not use on high-quality turf or other areas where some turf color changes cannot be tolerated. Slight turf discoloration may occur but turf will regreen and regrow under moist conditions as effects of this product wear off.

Apply 4 to 6 fluid ounces of this product per acre alone or in a recommended tank mixture. Spray volumes of 10 to 40 gallons per acre are recommended.

When using this product, mix 2 quarts of a nonionic surfactant per 100 gallons of spray solution.

This product can be used for growth and seedhead suppression of:

Tall Fescue
Smooth Brome

For best results, apply this product in a recommended tank mixture to actively growing turfgrasses after greenup in the spring of the year. For suppression of seedheads, applications must be made before boot-to-seedhead stage of development. Applications made from seedhead emergence until maturity may result in turf discoloration or injury.

After mowing or removal of seedheads, this product in a recommended tank mixture may also be used to suppress the growth of certain turfgrasses. Allow turf to recover from stress caused by heat, drought, or mowing before making applications. Applications made to turf under stress may increase the potential for discoloration or injury.

ANNUAL GRASSES

For growth suppression of some annual grasses such as annual ryegrass, wild barley and wild oats, apply 3 to 4 fluid ounces of this product in 10 to 40 gallons of spray solution per acre. Applications should be made when annual grasses are actively growing and before the seedheads are in the boot stage of development. Treatments made after seedhead emergence may cause injury to the desired grasses.

TANK MIXTURES

For the following tank mixtures, consult each product label for weeds controlled and the correct stage of application. Do not treat turf under stress.

Tank mixtures plus 2,4-D Amine

For additional weed control benefits, up to 1 pound a.i. per acre of 2,4-D amine may be added to the following tank mixtures. Consult the label for 2,4-D amine for weeds controlled.

TALL FESCUE

Roundup plus Telar™

For suppression of tall fescue growth and seedheads, and control or partial control of some annual weeds, apply this tank mixture after greenup and prior to boot-to-seedhead stage of development. Use up to ½ ounce of Telar per acre.

This tank mixture can also be applied after mowing or removal of tall fescue seedheads for turf growth suppression. Make only one of the above applications per growing season.

Roundup plus Oust™

For suppression of tall fescue growth and seedheads, and control or partial control of some annual weeds, apply this tank mixture after greenup and prior to boot-to-seedhead stage of development. Use up to 1/4 ounce of Oust per acre.

Roundup plus Escort™

This tank mixture can be applied after mowing or removal of tall fescue seedheads for turf growth suppression and control or partial control of some annual weeds. Use up to 1/3 ounce of Escort per acre.

SMOOTH BROME

Roundup plus Oust

For suppression of smooth brome growth and seedheads and control or partial control of some annual weeds, apply this tank mixture after greenup and prior to boot-to-seedhead stage of development. Use up to 1/4 ounce of Oust per acre.

™Escort and Telar are trademarks of E. I. du Pont de Nemours and Company.

BAHIAGRASS SEEDHEAD AND VEGETATIVE SUPPRESSION

When applied as directed in the indicated noncrop areas (roadsides, airports, golf course roughs, and plant sites), this product will provide significant inhibition of seedhead emergence and will suppress vegetative growth for a period of approximately 45 days with single applications and approximately 120 days with sequential applications.

Apply this product 1 to 2 weeks after full greenup of bahiagrass or after the bahiagrass has been mowed to a uniform height of 3 to 4 inches. Applications must be made prior to seedhead emergence. Apply 6 fluid ounces per acre of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 10 to 25 gallons of water per acre.

Sequential applications of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume may be made at approximately 45 day intervals to extend the period of seedhead and vegetative growth suppression. For continued seedhead suppression, sequential applications must be made prior to seedhead emergence. Apply no more than 2 sequential applications per year. As a first sequential application, apply 4 fluid ounces of this product per acre plus nonionic surfactant. A second sequential application of 2 to 4 fluid ounces per acre plus nonionic surfactant may be made approximately 45 days after the last application.

A tank mixture of this product plus Oust may be applied only on roadsides for seedhead inhibition and vegetative suppression. Apply 6 fluid ounces per acre of this product plus 0.25 ounce per acre of Oust, plus 0.5 to 1 percent nonionic surfactant by total spray volume 1 to 2 weeks following an initial spring mowing. When using this product plus Oust for suppression of bahiagrass, make only one application per year.

CROPPING SYSTEMS

When applied as directed for "Cropping Systems", under the conditions described, this product controls annual and perennial weeds listed on this label, prior to the emergence of direct seeded crops or prior to transplanting of crops listed on this label.

See "General Information" and "Mixing, Additives and Application Instructions" sections of this label for essential product performance information.

See the following "Cropping Systems" sections for specific recommended uses.

EXTREME CARE MUST BE EXERCISED TO AVOID CONTACT OF SPRAY WITH FOLIAGE, GREEN STEMS OR FRUIT OF DESIRABLE CROPS, PLANTS, TREES OR OTHER DESIRABLE VEGETATION SINCE SEVERE DAMAGE OR DESTRUCTION MAY RESULT.

Repeat treatments may be necessary to control weeds regenerating from underground parts or seed. Except as otherwise specified on this label, repeat treatments must be made before the crop emerges in accordance with the instructions of this label.

Except as otherwise specified in a crop section of this label, the combined total of all treatments must not exceed 8 quarts per acre of this product per year.

Do not plant subsequent crops other than those on the label for 30 days following application.

Do not harvest or feed treated vegetation for 8 weeks following application. Following spot treatment or selective equipment use, allow 14 days before grazing domestic livestock or harvesting forage grasses and legumes.

ALFALFA*	**LETTUCE**
ARTICHOKE, JERUSALEM	**LOGANBERRY**
ASPARAGUS*	**LONGAN**
ATEMOYA	**LYCHEE**
BARLEY*	**MELONS*****
BEANS (All)	**MUSTARD GREENS**
BEET GREENS	**OATS***
BEETS (Red, Sugar)	**OKRA**
BLACKBERRY	**OLALLIEBERRY**
BLUEBERRY	**ONION**
BOYSENBERRY	**PARSNIPS**
BREADFRUIT	**PASSION FRUIT**
BROCCOLI	**PEANUTS**
CABBAGE	**PEAS (All)**
CANISTEL	**PEPPER*****
CARAMBOLA	**PERSIMMONS**
CARROT	**PINEAPPLE******
CAULIFLOWER	**POTATO (Irish, Sweet)**
CELERY	**PUMPKIN*****
CHICORY	**RADISH**
CORN (All)*	**RASPBERRY (Black, Red)**
COTTON*	**RICE****
CRANBERRY	**RUTABAGA**
CUCUMBER***	**SAPODILLA**
CURRANT	**SAPOTE (Black, Mamey, White)**
DATES	**SORGHUM (Milo)***
DEWBERRY	**SOURSOP**
EGGPLANT***	**SOYBEANS***
ELDERBERRY	**SPINACH**
FORAGE GRASSES*	**SQUASH*** (Summer, Winter)**
FORAGE LEGUMES*	
GARLIC***	**SUGAR APPLE**
GOOSEBERRY	**TAMARIND**
GOURDS***	**TOMATILLO*****
HORSERADISH	**TOMATOES***†**
HUCKLEBERRY	**TURNIPS**
JABOTICABA	**WATERCRESS*****
JACKFRUIT	**WATERMELON*****
KALE	**WHEAT***
LENTILS	**YAMS**

*Spot treatments may be applied in these crops.

**Do not treat rice fields or levees when the fields contain flood water.

***Apply only prior to planting. Allow at least 3 days between application and planting.

****Do not feed or graze treated pineapple forage following application.

† Use is restricted to direct seeded crops only.

When applying this product prior to transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. Residues can be removed by 1/2 inch natural rainfall or by applying water via a sprinkler irrigation system.

Spot Treatment (Only those crops with "*" can be spot treated.)—Applications in growing crops must be made prior to heading of small grains and milo, initial pod set in soybeans, silking of corn, or boll opening on cotton.

For forage grasses and forage legumes see "Spot Treatment" in the "Pastures" section of "Cropping Systems" in this label.

For dilution and rates of application using boom or handheld equipment, see "Mixing, Additives and Application Instructions" and "Weeds Controlled" sections of this label.

NOTE: FOR FORAGE GRASSES AND FORAGE LEGUMES, NO MORE THAN ONE-TENTH OF ANY ACRE SHOULD BE TREATED AT ONE TIME. FOR ALL OTHER CROPS, DO NOT TREAT MORE THAN 10 PERCENT OF THE TOTAL FIELD AREA TO BE HARVESTED.

THE CROP RECEIVING SPRAY IN TREATED AREA WILL BE KILLED. TAKE CARE TO AVOID DRIFT OR SPRAY OUTSIDE TARGET AREA FOR THE SAME REASON.

Selective Equipment—This product may be applied through recirculating sprayers, shielded applicators, or wiper applicators in cotton and soybeans. Shielded and wiper applicators may also be used in tree crops and grapes. Wiper applicators may be used in rutabagas, forage grasses and forage legumes, including pasture sites and grain sorghum (milo).

See the "Selective Equipment" part of the "Application Equipment and Techniques" section of this label for information on proper use and calibration of this equipment.

Allow at least the following time intervals between application and harvest:

Cotton, Soybeans . . . . . 7 days

Apples, Atemoya, Avocado, Breadfruit, Canistel, Carambola, Cherry, Citrus, Dates, Grapes, Jaboticaba, Jackfruit, Longan, Lychee, Passion Fruit, Pear, Persimmons, Rutabagas, Sapodilla, Sapote, Soursop, Sugar Apple, Tamarind . . . . 14 days

Stone Fruit . . . . . 17 days

Nut Crops . . . . . 21 days

Sorghum (milo)* . . . . . days

*Do not use roller applicators. Do not feed or graze treated milo fodder. Do not ensile treated vegetation

ASPARAGUS

When applied as directed for "Cropping Systems" under the conditions described, this product controls weeds listed on this label in asparagus.

For specific rates of applications and instructions for control of various annual and perennial weeds, see the "Weeds Controlled" section of this label.

Prior to Crop Emergence—Apply this product prior to crop emergence for the control of emerged labeled annual and perennial weeds. DO NOT APPLY WITHIN WEEK BEFORE THE FIRST SPEARS EMERGE.

Spot Treatment—Apply this product immediately after cutting, but prior to the emergence of new spears. Do not treat more than 10 percent of the total field area to be harvested. Do not harvest within 5 days of treatment.

Postharvest—Apply this product after the last harvest and all spears have been removed. If spears are allowed to regrow, delay application until ferns have developed. Delayed treatments should be applied as directed or shielded spray in order to avoid contact of the spray with ferns, stems or spears. Direct contact of the spray with the asparagus may result in serious crop injury.

NOTE: Select and use recommended types of spray equipment for postemergence postharvest applications. A directed spray is any application where the spray pattern is aligned in such a way as to avoid direct contact of the spray with the crop. A shielded spray is any application where a physical barrier is positioned and maintained between the spray and the crop to prevent contact of spray with the crop.

BERRIES AND SMALL FRUITS

For cranberries, apply after fruit set and no later than 3 days before harvest.

For other berries, apply as a preplant broadcast application, or as a directed spray or wiper application post-planting.

Wiper applicators may be used in cranberries in accordance with instructions in this section.

See "General Information" and "Mixing, Additives and Application Instructions" sections of this label for essential product performance information.

See the "Selective Equipment" part of the "Application Equipment and Techniques" section of this label for information on recommended use and calibration of the equipment.

For Wick or other Wiper Applicators—Mix 1 gallon of this product in 4 gallons of water to prepare a 20 percent solution. Apply the solution to emerged weeds. Apply after cranberry fruit set and no later than 30 days before harvest.

In severe infestations, reduce equipment ground speed to ensure that adequate amounts of this product are wiped on the weeds. A second treatment in the opposite direction may be beneficial.

Do not permit herbicide solution to contact desirable vegetation, including green shoots, canes, or foliage.

For specific rates of application and instructions for control of various annual and perennial weeds and woody brush and trees, see the "Weeds Controlled" section of this label.

This product may be applied with recirculating sprayers, shielded applicators, or wiper applicators in any noncrop site specified on this label. See the "Selective Equipment part of "Application Equipment and Techniques" section of this label for information on proper use and calibration of this equipment.

TANK MIXTURES FOR INDUSTRIAL SITES

ROUNDUP® plus OUST™

Use on industrial sites including airports, industrial plants, lumberyards, petroleum tank farms, pumping stations, pipelines, railroads, roadsides, storage areas or other similar sites where bare ground is desired.

When applied as directed for "Noncrop Uses" under the conditions described, this product plus Oust provides control of annual weeds listed in the "Weeds Controlled" section of the label for this product and Oust, and control or partial control of the perennial weeds listed below.

Apply 1 to 2 quarts of this product with 2 to 4 ounces of Oust in 10 to 40 gallons of spray solution per acre as a broadcast spray to actively growing weeds.

This product plus Oust tank mixtures may not be applied by air in California.

For control of annual weeds, use the lower rates of these products.

For control of the listed perennial weeds, use the higher rates of both products. For partial control, use the lower rates.

Bahiagrass
Paspalum notatum

Bermudagrass*
Cynodon dactylon

Broomsedge
Andropogon virginicus

Dock, curly
Rumex crispus

Dogfennel
Eupatorium capilliforium

Fescue, tall
Festuca arundinacea

Johnsongrass**
Sorghum halepense

Poorjoe**
Diodia teres

Quackgrass
Agropyron repens

Trumpetcreeper*
Campsis radicans

Vaseygrass
Paspalum urvillei

Vervain, blue
Verbena hastata

*Suppression at the higher rates only.

**Control at the lower rates.

Read and carefully observe the cautionary statements and all other information appearing on the labels of all herbicides used.

™Oust is a trademark of E. I. du Pont de Nemours and Company.

TANK MIXTURES NONCROP SITES

When applied as a tank mixture, this product provides control of the emerged annual weeds and partial control of the emerged perennial weeds listed in this label. When applied as a tank mixture, the following residual herbicides will provide preemergence control of the weeds listed in the individual product labels.

- ROUNDUP® plus DIURON
- ROUNDUP plus KROVAR™ I
- ROUNDUP plus KROVAR II
- ROUNDUP plus RONSTAR™ 50WP
- ROUNDUP plus SIMAZINE, PRINCEP™ CALIBER™ 90
- ROUNDUP plus SIMAZINE 4L
- ROUNDUP plus SIMAZINE 80W
- ROUNDUP plus SURFLAN™ 75W
- ROUNDUP plus SURFLAN AS

When tank mixing with residual herbicides, add an agriculturally approved nonionic surfactant at 0.5 to 1 percent by volume of spray solution. See the "Mixing, Additives and Application Instructions" section of this label before preparing these tank mixtures.

Read and carefully observe the label claims, cautionary statements, recommended use rates and all other information on the labels of all products used in these tank mixtures. Use according to the most restrictive label directions for each product in the mixture.

CONTROL OF EMERGED WEEDS

Annual Weeds—Apply 1 quart per acre of this product in these tank mixtures when weeds are less than 6 inches tall and 1½ quarts per acre when weeds are more than 6 inches tall.

Perennial Weeds—For partial control of perennial weeds using these tank mixtures, apply 2 to 5 quarts per acre of this product. Follow the recommendations in the "Weeds Controlled" section of this label for stage of growth and rate of application for specific perennial weeds.

PREEMERGENCE WEED CONTROL

For preemergence weed control, refer to the individual product labels for specific noncrop sites, rates, carrier volumes and precautionary statements.

Mix only the quantity of spray solution which can be used during the same day. Do not allow these tank mixtures to stand overnight as this may result in reduced weed control.

APPLY THESE TANK MIXTURES THROUGH CONVENTIONAL BROADCAST EQUIPMENT ONLY.

™Princep and Caliber are trademarks of Ciba-Geigy Corporation.
™Krovar is a trademark of E.I. du Pont de Nemours and Company.
™Ronstar is a trademark of Rhone-Poulenc, Inc.
™Surflan is a trademark of Elanco Products Company.

FARMSTEAD WEED CONTROL

When applied as directed for "Noncrop Uses", under conditions described, this product controls undesirable vegetation listed on this label around farmstead building foundations, along and in fences, shelterbelts, and for general nonselective farmstead weed control.

For specific rates of application and instructions for control of various annual and perennial weeds, see the "Weeds Controlled" section of this label.

ORNAMENTALS AND CHRISTMAS TREES

THIS PRODUCT IS NOT RECOMMENDED FOR USE AS AN OVER-THE-TOP BROADCAST SPRAY IN ORNAMENTALS AND CHRISTMAS TREES.

When applied as instructed for the conditions described for "Noncrop Uses", this product controls undesirable vegetation listed on this label prior to planting ornamentals, within and around greenhouses and shadehouses, and as a postdirected spray around established ornamentals.

For specific rates of application and instructions for control of various annual and perennial weeds, see the "Weeds Controlled" section of this label.

When repeat applications are necessary, do not exceed 10.6 quarts of this product per acre per year.

Site Preparation—Following preplant applications of this product, any ornamental species may be planted.

Precautions should be taken to protect nontarget plants during site preparation applications.

Greenhouse/Shadehouse Use—This product may be used to control weeds listed on this label which are growing in greenhouses. Desirable vegetation must not be present during application and air circulation fans must be turned off.

Postdirected Spray—Use as a postdirected spray around established woody ornamental species such as those listed below. Care must be exercised to avoid contact of spray, drift or mist with foliage or green bark of established ornamental species.

Arborvitae
Thuja spp.

Azalea
Rhododendron spp.

Boxwood
Buxus spp.

Crabapple
Malus spp.

Euonymus
Euonymus spp.

Fir
Abies spp.
Pseudotsuga spp.

Jojoba
Simmondsia chinensis

Hollies
Ilex spp.

Lilac
Syringa spp.

Magnolia
Magnolia spp.

Maple
Acer spp.

Oak
Quercus spp.

Privet
Ligustrum spp.

Pine
Pinus spp.

Spruce
Picea spp.

Yew
Taxus spp.

CUT STUMP TREATMENTS

Woody vegetation may be controlled by treating freshly cut stumps of trees and resprouts with this product. Apply this product using suitable equipment to ensure coverage of the entire cambium. Cut vegetation close to the soil surface. Apply a 50 to 100 percent solution of this product to the freshly cut surface immediately after cutting. Delays in application may result in reduced performance. For best results, applications should be made during periods of active growth and full leaf expansion.

When used according to directions for cut stump application, this product will CONTROL, PARTIALLY CONTROL or SUPPRESS many types of woody brush and tree species, some of which are listed below:

Alder
Alnus spp.

Eucalyptus/Bluegum
Eucalyptus glotulus

Madrone
Arbutus menziesii

Oak
Quercus spp.

Reed, giant
Arundo donax

Saltcedar
Tamarisk spp.

Sweetgum
Liquidambar styraciflua

Tan Oak
Lithocarpus densiflorus

INJECTION AND FRILL APPLICATIONS

Woody vegetation may be controlled by injection or frill application of this product. Apply this product using

suitable equipment which must penetrate into the living tissue. Apply the equivalent of 1 ml of this product per each 2 to 3 inches of trunk diameter (DBH). This is best achieved by applying 50 to 100 percent concentration of this material either to a continuous frill around the tree or as cuts evenly spaced around the tree below all branches. As tree diameter increases in size, better results are achieved by applying diluted material to a continuous frill or more closely spaced cuttings. Avoid application techniques that allow runoff to occur from frill or cut areas in species that exude sap freely after frills or cutting. In species such as this, make frill or cut at an oblique angle so as to produce a cupping effect and use undiluted material. For best results, application should be made during periods of active growth and after full leaf expansion.

This treatment WILL CONTROL the following woody species:

Oak *Quercus spp.*
Sweetgum *Liquidambar styraciflua*
Poplar *Populus spp.*
Sycamore *Platanus occidentalis*

This treatment WILL SUPPRESS the following woody species:

Black gum *Nyssa sylvatica*
Hickory *Carya spp.*
Dogwood *Cornus spp.*
Maple, red *Acer rubrum*

TURFGRASSES AND GRASSES FOR SEED PRODUCTION

PREPLANT AND RENOVATION

When applied as directed for "Noncrop Uses", under conditions described, this product controls most existing vegetation prior to the planting or renovation of either turfgrasses or grass seed production areas.

For specific rates of application and instructions for control of various annual and perennial weeds, and woody brush and trees, see the "Weeds Controlled" section of this label.

For maximum control of existing vegetation, delay planting to determine if any regrowth from escaped underground plant parts occurs. Where repeat treatments are necessary, sufficient regrowth must be attained prior to application. For warm-season grasses, such as bermudagrass, summer or fall applications provide best control.

DO NOT DISTURB SOIL OR UNDERGRDUND PLANT PARTS BEFORE TREATMENT. Tillage or renovation techniques such as vertical mowing, coring or slicing should be delayed for 7 days after application to allow proper translocation into underground plant parts.

TURFGRASSES

Where existing vegetation is growing in a field or unmowed situation, apply this product to actively growing weeds at the stages of growth given in the "Weeds Controlled" section of this label.

Where existing vegetation is growing under mowed turfgrass management, apply this product after omitting at least one regular mowing to allow sufficient growth for good interception of the spray.

Desirable turfgrasses may be planted following the above procedures.

GRASSES FOR SEED PRODUCTION

Apply this product to actively growing weeds at the stages of growth given in the "Weeds Controlled" section of this label prior to planting or renovation of turf or forage grass areas grown for seed production.

DO NOT feed or graze treated areas within 8 weeks after application.

ANNUAL WEED CONTROL IN DORMANT BERMUDAGRASS AND BAHIAGRASS TURF

When applied as directed for "Noncrop Uses" under the conditions described, this product will provide control or suppression of many winter annual weeds and tall fescue for effective release of dormant bermudagrass and bahiagrass turf. Refer to the rate table for Roundup alone under the "Release of Bermudagrass and Bahiagrass" section of this label for recommended rates and volumes on the species to be suppressed or controlled. Treat only when turf is dormant and prior to spring greenup. Spot treatments or broadcast applications of this product in excess of 16 fluid ounces per acre may result in injury or delayed greenup in highly maintained turfgrass areas; i.e., golf courses, lawns, etc. DO NOT APPLY TANK MIXTURES of this product plus Oust in highly maintained turfgrass areas.

RELEASE OF BERMUDAGRASS OR BAHIAGRASS

NOTE: Use only in areas where bermudagrass or bahiagrass are desirable ground covers and where some temporary injury or discoloration can be tolerated. Use tank mixtures of this product plus Oust only on railroads, highways, utility plant sites, or other right-of-way areas.

When applied as directed for "Noncrop Uses" under the conditions described, this product will provide control or suppression of many winter annual weeds and tall fescue for effective release of dormant bermudagrass or bahiagrass. This product may be tank-mixed with Oust as recommended for residual control. Make applications to dormant bermudagrass or bahiagrass. Tank mixtures of this product plus Oust may delay greenup. To avoid delays in greenup and minimize injury, do not add more than 1 ounce per acre of Oust on bermudagrass or more than ½ ounce per acre on bahiagrass, or treat when these grasses are in a semi-dormant condition.

For best results on winter annuals, treat when plants are in an early growth stage (below 6 inches in height) after most have germinated. For best results on tall fescue, treat when fescue is in or beyond the 4 to 6-leaf stage.

WEEDS CONTROLLED

Rate recommendations for control or suppression of winter annuals and tall fescue are listed below:

Apply the recommended rates of this product alone or as a tank mixture in 10 to 25 gallons of water, plus 0.5 to 1 percent nonionic surfactant by total spray volume per acre.

For the best recommendation for the mixture of weeds within your geographic areas, contact your Monsanto sales representative.

WEEDS CONTROLLED OR SUPPRESSED WITH ROUNDUP® ALONE*

NOTE: C = Control
S = Suppression

	ROUNDUP FLUID OZ/ACRE					
WEED SPECIES	8	12	16	24	32	64
Barley, little *Hordeum pusilium*	S	C	C	C	C	C
Bedstraw, catchweed *Galium aparine*	S	C	C	C	C	C
Bluegrass, annual *Poa annua*	S	C	C	C	C	C
Chervil *Chaerophyllum tainturieri*	S	C	C	C	C	C
Chickweed, common *Stellaria media*	S	C	C	C	C	C
Clover, crimson *Trifolium incarnatum*	•	S	S	C	C	C
Clover, large hop *Trifolium campestre*	•	S	S	C	C	C
Fescue, tall *Festuca arundinaceae*	•	•	•	•	S	S
Geranium, Carolina *Geranium carolinianum*	•	•	S	S	C	C
Henbit *Lamium amplexicaule*	•	S	C	C	C	C
Ryegrass Italian *Lolium multiflorum*	•	•	S	C	C	C
Speedwell, corn *Veronica arvensis*	S	C	C	C	C	C
Vetch, common *Vicia sativa*	•	•	S	C	C	C

*These rates apply only to sites where an established competitive turf is present.

WEEDS CONTROLLED OR SUPPRESSED WITH ROUNDUP® PLUS OUST*

NOTE: C = Control
S = Suppression

	ROUNDUP + OUST							
WEED SPECIES	ROUNDUP (FL. OZ/A) + OUST (OZ/A)	8 + ½	12 + ¼	12 + ½	16 + ¼	16 + ½	12 + 1	16 + 1
Barley, little *Hordeum pusilium*		C	C	C	C	C	C	C
Bedstraw, catchweed *Galium aparine*		C	C	C	C	C	C	C
Bluegrass, annual *Poa annua*		S	C	C	C	C	C	C
Chervil *Chaerophyllum tainturieri*		C	C	C	C	C	C	C
Chickweed, common *Stellaria media*		S	C	C	C	C	C	C
Clover, crimson *Trifolium incarnatum*		S	S	S	S	S	C	C
Clover, large hop *Trifolium campestre*		•	•	S	S	S	C	C
Fescue, tall *Festuca arundinaceae*		•	•	•	•	•	S	S

Muhly, wirestem—Apply 1 to 2 quarts of this product per acre. Use 1 quart of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. Use 2 quarts of this product when applying 10 to 40 gallons of water per acre or in pasture, sod, or noncrop areas. Spray when the wirestem muhly is 8 inches or more in height and actively growing. Do not till between harvest and fall applications or in the fall or spring prior to spring applications. Allow 3 or more days after application before tillage. This product will not provide residual control of wirestem muhly from seeds which germinate after application of this product. Do not tank mix with residual herbicides when using the 1 quart per acre rate.

Nightshade, silverleaf—For control, apply 2 quarts of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. Applications should be made when at least 60 percent of the plants have berries. Fall treatments must be applied before a killing frost. Allow 7 or more days after application before tillage. Do not treat when weed is under drought stress as good soil moisture is necessary for active growth.

Nutsedge: purple, yellow—Apply 3 quarts of this product per acre as a broadcast spray, or apply a 2 percent solution from hand-held equipment to control existing nutsedge plants and immature nutlets attached to treated plants. Treat when plants are in flower or when new nutlets can be found at rhizome tips. Nutlets which have not germinated will not be controlled and may germinate following treatment. Repeat treatments will be required for long-term control of ungerminated tubers.

Sequential applications of 1 to 2 quarts of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre will provide control. Make applications when a majority of the plants are in the 3 to 5-leaf stage (less than 6 inches tall). Repeat this application, as necessary, when newly emerging plants reach the 3 to 5-leaf stage. Subsequent applications will be necessary for long-term control.

For suppression to partial control of existing plants, apply 1 pint to 2 quarts of this product per acre, plus 0.5 to 1 percent nonionic surfactant in 3 to 40 gallons of water per acre. Treat when plants have 3 to 5 leaves and most are less than 6 inches tall. Repeat treatments will be required to control subsequent emerging plants or regrowth of existing plants. Wait 7 days after treatment before tillage or mowing.

Pampas—Apply this product as a 1½ to 2 percent solution using hand-held equipment. Apply to plants that are actively growing at or beyond the boot stage of growth. Thorough coverage is necessary for best control.

Phragmites—For partial control of phragmites in Florida and the counties of other states bordering the Gulf of Mexico, apply 5 quarts per acre as a broadcast spray or apply a 2 percent solution from hand-held equipment. In other areas of the U.S., apply 3 quarts per acre as a broadcast spray or apply a 1 percent solution from hand-held equipment for partial control. For best results, treat during late summer or fall months or when plants are actively growing and in full bloom. Treatment before or after this stage may lead to reduced control. Due to the dense nature of the vegetation, which may prevent good spray coverage or uneven stages of growth, repeat treatments may be necessary to maintain control. Visual control symptoms will be slow to develop.

Quackgrass—In Annual Cropping Systems, or in Pastures and Sods Followed by Deep Tillage: Apply 1 to 2 quarts of this product per acre. For the one quart rate, apply 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. For the 2 quart rate, apply in 10 to 40 gallons of water per acre. Do not tank mix with residual herbicides when using the 1 quart rate. Spray when quackgrass is 6 to 8 inches in height and actively growing. Do not till between harvest and fall applications or in fall or spring prior to spring application. Allow 3 or more days after application before tillage. In pastures or sods, for best results use a moldboard plow.

Quackgrass—Pasture or Sod or Other Noncrop Areas Where Deep Tillage is Not Planned Following Application: Apply 2 to 3 quarts in 10 to 40 gallons of water per acre. Spray when the quackgrass is greater than 8 inches tall and actively growing. Do not till between harvest and fall application or in fall or spring prior to spring application. Allow 3 or more days after application before tillage.

Redvine—For suppression, apply 24 fluid ounces of this product per acre at each of two applications 7 to 14 days apart or a single application of 2 quarts per acre. Apply recommended rates in 5 to 10 gallons of water per acre plus 0.5 to 1 percent nonionic surfactant by total volume. Apply to actively growing plants in late September or early October, which are at least 18 inches tall and have been growing 45 to 60 days since the last tillage operation. Make applications at least one week before a killing frost.

Reed, giant—For control of giant reed, apply a 2 percent solution of this product when plants are actively growing. Best results are obtained when applications are made in late summer to fall.

Smartweed, swamp—Apply 3 to 5 quarts of this product per acre when plants are actively growing and most have reached the early bud stage of growth. Allow 7 or more days after application before tillage.

Also for control, apply 16 fluid ounces of this product plus 0.5 pound active ingredient of 2,4-D plus 0.5 to 1 percent nonionic surfactant by total volume in 3 to 10 gallons of water per acre in the late summer or fall. Apply when plants are actively growing and most have reached the early bud stage of growth. Allow 7 or more days after application before tillage.

Spurge, leafy—For suppression, apply 16 fluid ounces of this product plus 0.5 pound active ingredient 2,4-D plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre in the late summer or fall. Apply when plants are actively growing. If mowing has occurred prior to treatment, apply when most of the plants are 12 inches tall. Allow 7 or more days after application before tillage.

Sweet Potato, wild—Apply this product as a 2 percent solution using hand-held equipment. Apply to actively growing weeds that are at or beyond the bloom stage of growth. Repeat applications will be required. Allow the plant to reach the recommended stage of growth before retreatment. Allow 7 or more days before tillage.

Thistle, Canada—Apply 2 to 3 quarts of this product per acre. Apply to actively growing thistles when most are at or beyond the bud stage of growth. After harvest, mowing or tillage in the late summer or fall, allow at least 4 weeks for initiation of active growth and rosette development prior to the application of this product. Fall treatments must be applied before a killing frost. Allow 3 or more days after application before tillage.

For suppression of Canada thistle, apply 1 quart per acre of this product, or 1 pint of this product plus 0.5 pound a.i. 2,4-D per acre, plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre in the late summer or fall after harvest, mowing or tillage. Allow rosette regrowth to a minimum of 6 inches in diameter before treating. Applications can be made as long as leaves are still green and plants are actively growing at the time of application. Allow 3 or more days after application before tillage.

Torpedograss—Apply 4 to 5 quarts of this product per acre to provide partial control of torpedograss. Apply to actively growing torpedograss when most plants are at or beyond the seedhead stage of growth. Repeat applications will be required to maintain control. Fall treatments must be applied before frost. Allow 7 or more days after application before tillage.

Trumpetcreeper—For control, apply 2 quarts of this product per acre in 5 to 10 gallons of water per acre. Apply to actively growing plants in late September or October, which are at least 18 inches tall and have been growing 45 to 60 days since the last tillage operation. Make applications at least 1 week before a killing frost.

Other perennials listed on this label—Apply 3 to 5 quarts of this product per acre. Apply when actively growing and most have reached early head or early bud stage of growth. Allow 7 or more days after application before tillage.

WOODY BRUSH AND TREES

When applied as recommended under the conditions described, this product CONTROLS or PARTIALLY CONTROLS the following woody brush, plants and trees:

Alder
Alnus spp.

Ash*
Fraxinus spp.

Aspen, quaking
Populus tremuloides

Bearmat (Bearclover)
Chamaebatia foliolosa

Birch
Betula spp.

Blackberry
Rubus spp.

Broom:
French
Cytisus monspessulanus

Scotch
Cytrsus scoparius

Buckwheat, California*
Eriogonum fasciculatum

Cascara*
Rhamnus purshiana

Catsclaw*
Acacia greggi

Ceanothus*
Ceanothus spp.

Chamise
Adenostoma fasciculatum

Cherry:
Bitter
Prunus emarginata

Black
Prunus serotina

Pin
Prunus pensylvanica

Maple:
Red**
Acer rubrum

Sugar
Acer saccharum

Vine*
Acer circinatum

Monkey Flower*
Mimulus guttatus

Oak:
Black*
Quercus velutina

Northern Pin
Quercus palustris

Post
Quercus stellata

Red
Quercus rubra

Southern Red
Quercus falcata

White*
Quercus alba

Persimmon*
Diospyros spp.

Poison Ivy
Rhus radicans

Poison Oak
Rhus toxicodendron

Poplar*, yellow
Liriodendron tulipifera

Raspberry
Rubus spp.

Coyote brush
Baccharis consanguinea

Creeper, Virginia*
Parthenocissus quinquefolia

Dewberry
Rubus trivialis

Elderberry
Sambucus spp.

Elm*
Ulmus spp.

Eucalyptus, Bluegum
Eucalyptus globulus

Hasardia*
Haplopappus squamosus

Hawthorn
Crataegus spp.

Hazel
Corylus spp.

Honeysuckle
Lonicera spp.

Kudzu
Pueraria lobata

Locust, black*
Robinia pseudoacacia

Madrone
Arbutus menziesii

Manzanita
Arctostaphylos spp.

Rose, multiflora
Rosa multiflora

Russian-olive***
Elaeagnus angustifolia

Sage, black
Salvia mellifera

Sagebrush, California
Artemisia californica

Salmonberry
Rubus spectabilis

Sassafras
Sassafras albidum

Sourwood
Oxydendrum arboreum

Sumac:
Poison*
Rhus vernix

Smooth*
Rhus glabra

Winged*
Rhus copallina

Sweetgum
Liquidambar styraciflua

Swordfern*
Polystichum munitum

Tallowtree, Chinese
Sapium sebiferum

Tan Oak
Lithocarpus densiflorus

Thimbleberry
Rubus parviflorus

Tobacco, tree*
Nicotiana glauca

Trumpetcreeper
Campsis radicans

Willow
Salix spp.

*Partial control

**See below for control or partial control instructions

***This product is not registered in California for use on Russian-olive.

NOTE: If brush has been mowed or tilled or trees have been cut, do not treat until regrowth has reached the recommended stages of growth.

Apply this product when plants are actively growing and, unless otherwise directed, after full leaf expansion. Use the higher rate for larger plants and/or dense areas of growth. On vines, use the higher rate for plants that have reached the woody stage of growth. Best results are obtained when application is made in late summer or fall after fruit formation.

In arid areas, best results are obtained when application is made in the spring to early summer when brush species are at high moisture content and are flowering. Ensure thorough coverage when using hand-held equipment. Symptoms may not appear prior to frost or senescence with fall treatments.

Allow 7 or more days after application before tillage, mowing or removal. Repeat treatments may be necessary to control plants regenerating from underground parts or seed. Some autumn colors on undesirable deciduous species are acceptable provided no major leaf drop has occurred. Reduced performance may result if fall treatments are made following a frost.

See "Directions for Use", and "Mixing, Additives, and Application Instructions" sections of this label for labeled uses and specific application instructions.

Apply this product as follows to control or partially control the following woody brush and trees.

Alder/Dewberry/Honeysuckle/Post Oak/Raspberry—For control, apply 3 to 4 quarts per acre of this product as a broadcast spray or as a 1 to 1½ percent solution with hand-held equipment.

Aspen, quaking/Cherry: bitter, black, pin/Hawthorn /Oak, southern red/Sweetgum/Trumpetcreeper— For control, apply 2 to 3 quarts of this product per acre as a broadcast spray or as a 1 to 1½ percent solution with hand-held equipment.

Birch/Elderberry/Hazel/Salmonberry/ Thimbleberry— For control, apply 2 quarts per acre of this product as a broadcast spray or as a 1 percent solution with hand-held equipment.

Blackberry—For control, apply 3 to 4 quarts per acre of this product as a broadcast spray, or 1 to 1½ percent solution with hand-held equipment. Make application after plants have reached full leaf maturity. Best results are obtained when applications are made in late summer or fall. After berries have set or dropped in late fall, blackberry can be controlled by applying a 3/4 percent solution of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume with hand-held equipment. For control of blackberries after leaf drop and until killing frost or as long as stems are green, apply 3 to 4 quarts of this product in 10 to 40 gallons of water per acre.

Broom: French, Scotch—For control, apply a 1½ to 2 percent solution with hand-held equipment.

Buckwheat, California/Hasardia/Monkey Flower/ Tobacco, tree—For partial control of these species, apply a 1 to 2 percent solution of this product as a foliar spray with hand-held equipment. Thorough coverage of foliage is necessary for best results.

Catsclaw—For partial control, apply as a 1 to 1½ percent solution with hand-held equipment.

Coyote Brush—For control, apply a 1½ to 2 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.

Eucalyptus/Bluegum—For control of eucalyptus resprouts, apply a 2 percent solution of this product with hand-held equipment when resprouts are 6 to 12 feet tall. Ensure complete coverage. Apply when plants are growing actively. Avoid application to drought-stressed plants.

Kudzu—For control, apply 4 quarts of this product per acre as a broadcast spray or as a 2 percent solution with hand-held equipment. Repeat applications will be required to maintain control.

Madrone resprouts—For suppression or partial control, apply a 2 percent solution of this product to resprouts less than 3 to 6 feet tall. Best results are obtained with spring/early summer treatments.

Maple, red**—For control, apply as a 1 to 1½ percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed. For partial control, apply 2 to 4 quarts of this product per acre as a broadcast spray.

Maple, sugar/Oak, northern pin/Oak red—For control, apply as a 1 to 1½ percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.

Poison Ivy/Poison Oak—For control, apply 4 to 5 q... of this product per acre as a broadcast spray or as ... percent solution with hand-held equipment. Rep... applications may be required to maintain control. F... treatments must be applied before leaves lose gre... color.

Rose, multiflora—For control, apply 2 quarts of t... product per acre as a broadcast spray or as a 1 perce... solution with hand-held equipment. Treatments shou... be made prior to leaf deterioration by leaf-feedi... insects.

Sage, black/Sagebrush, California/Chamise/Tallowtre... Chinese—For control of these species, apply a 1 perce... solution of this product as a foliar spray with hand-he... equipment. Thorough coverage of foliage is necessary ... best results.

Tan oak resprouts—For suppression or partial control, a... ply a 2 percent solution of this product to resprouts le... than 3 to 6 feet tall. Best results are obtained with f... applications.

Willow—For control, apply 3 quarts of this product p... acre as a broadcast spray or as a 1 percent solution w... hand-held equipment.

Other Woody Brush and Trees listed on this label—F... partial control, apply 2 to 4 quarts of this product p... acre as a broadcast spray or as a 1 to 2 percent solutio... with hand-held equipment.

NONCROP USES

See "General Information" and "Mixing, Additives ar... Application Instructions" sections of this label for esse... bal product performance information and the followir... "Noncrop" sections for specific recommend... es.

EXTREME CARE MUST BE EXERCISED TO AVOID CO... TACT OF SPRAY WITH FOLIAGE OF DESIRABLE TUR... GRASSES, TREES, SHRUBS, OR OTHER DESIRABL... VEGETATION SINCE SEVERE DAMAGE OR DESTRUCTIO... MAY RESULT.

NOTE: If spraying areas adjacent to desirable plant... use a shield made of cardboard, sheet metal ... plyboard while spraying to help prevent spray from co... tacting foliage of desirable plants.

Repeat treatments may be necessary to control weed... regenerating from underground parts or seeds.

Where repeat applications are necessary, do not excee... 10.6 quarts of this product per acre per year.

This product does not provide residual weed control. Fo... subsequent weed control, follow a label-approved her... bicide program.

Read and carefully observe the cautionary statement... and all other information appearing on the labels of a... herbicides used.

INDUSTRIAL, RECREATIONAL AND PUBLIC AREAS

When applied as directed for "Noncrop Uses", unde... conditions described, this product controls annual an... perennial weeds listed on this label growing in ... ruc... as airports, ditch banks, dry ditches, dry canal... ence rows, golf courses, highways, industrial plant sites, lumber yards, parking areas, parks, petroleum tank farms and pumping installations, pipelines, railroads, roadsides, schools, storage areas, other public areas and similar industrial or noncrop areas.

NOTE: Refer to the specific product labels for crop rotation restrictions and cautionary statements of all products used in tank mixtures. Some crop injury may occur if Banvel is applied within 45 days of planting. The addition of Banvel in a mixture with this product may provide short-term residual control of selected weed species.

Apply 12 to 16 fluid ounces of this product plus 0.25 lb. a.i. of Banvel or 0.5 pound a.i. of 2,4-D, plus 0.5 to 1 percent nonionic surfactant by total spray volume per acre to control dense populations of the following annual broadleaf weeds when less than the height indicated:

Cocklebur (12") *Xanthium strumarium*
Morningglory (6") *Ipomoea spp.*
Kochia* (6") *Kochia scoparia*
Pigweed, redroot (12") *Amaranthus retroflexus*
Lambsquarters (12") *Chenopodium album*
Pigweed, smooth (12") *Amaranthus hybridus*
Lettuce, prickly (6") *Lactuca serriola*
Thistle, Russian (12") *Salsola kali*
Marestail/Horseweed (6") *Conyza canadensis*

*Controlled with Banvel tank mixture only.

Apply 16 fluid ounces of this product plus 0.5 pound a.i. of 2,4-D, plus 0.5 to 1 percent nonionic surfactant by total spray volume per acre to control the following annual broadleaf weeds when less than 6 inches in height.

Ragweed, common *Ambrosia artemisiifolia*
Smartweed, Pennsylvania *Polygonum pensylvanicum*
Ragweed, giant *Ambrosia trifioa*
Velvetleaf *Abutilon theophrasti*

HIGH-VOLUME BROADCAST APPLICATIONS

When applied as directed under the conditions described, this product will control the weeds listed below when water carrier volumes are 10 to 40 gallons per acre for ground applications.

Apply 1 to 1.5 quarts of this product per acre plus 0.5 to 1 percent nonionic surfactant by total spray volume. Use 1 quart per acre if weeds are less than 6 inches tall and 1.5 quarts per acre if weeds are over 6 inches tall. If weeds have been mowed, grazed, or cut, allow adequate time for new growth to recommended stages prior to treatment. These rates will also provide control of weeds listed in the "Low-Volume Broadcast Application" section.

WEED SPECIES

Balsamapple* *Momordica charantia*
Bassia, fivehook *Bassia hyssopifolia*
Brome *Bromus spp.*
Fiddleneck *Amsinckia spp.*
Flaxleaf Fleabane *Conyza bonariensis*
Fleabane *Erigeron spp.*
Kochia *Kochia scoparia*
Lettuce, prickly *Lactuca serriola*
Panicum *Panicum spp.*
Ragweed, common *Ambrosia artemisiifolia*
Ragweed, giant *Ambrosia trifida*
Smartweed, Pennsylvania *Polygonum pensylvanicum*
Sowthistle, annual *Sonchus oleraceus*
Sunflower *Helianthus annuus*
Thistle, Russian *Salsola kali*
Velvetleaf *Abutilon theophrasti*

*Apply with hand-held equipment only.

PERENNIAL WEEDS

Apply this product as follows to control or destroy most perennial weeds:

NOTE: If weeds have been mowed or tilled, do not treat until plants have resumed active growth and have reached the recommended stages.

Repeat treatments may be necessary to control weeds regenerating from underground parts or seed. Repeat treatments must be made prior to crop emergence.

The addition of 1 to 2 percent dry ammonium sulfate by weight or 8.5 to 17 pounds per 100 gallons of water may increase the performance of this product on perennial weeds. The improvement in performance may be apparent where environmental stress is a concern. Refer to the "Mixing, Additives and Application Instructions" section of this label.

When applied as recommended under the conditions described, this product WILL CONTROL the following PERENNIAL WEEDS:

Alfalfa *Medicago sativa*
Alligatorweed* *Alternanthera philoxeroides*
Artichoke, Jerusalem *Helianthus tuberosus*
Bahiagrass *Paspalum notatum*
Bentgrass *Agrostis spp.*
Bermudagrass *Cynodon dactylon*
Bermudagrass, water (knotgrass) *Paspalum distichum*
Bindweed, field *Convolvulus arvensis*
Bluegrass, Kentucky *Poa spp.*
Blueweed, Texas *Helianthus ciliaris*
Brackenfern *Pteridium aquilinum*
Bromegrass, smooth *Bromus inermis*
Bursage, woollyleaf *Franseria tomentosa*
Canarygrass, reed *Phalaris arundinacea*
Cattail *Typha spp.*
Clover, red *Trifolium pratense*
Clover, white *Trifolium repens*
Kikuyugrass *Pennisetum clandestinum*
Knapweed *Centaurea repens*
Lantana *Lantana camara*
Milkweed *Asclepias spp.*
Muhly, wirestem *Muhlenbergia frondonsa*
Mullein, common *Verbascum thapsus*
Napiergrass *Pennisetum purpureum*
Nightshade, silverleaf *Solanum elaeagnifolium*
Nutsedge, purple, yellow *Cyperus rotundus* *Cyperus esculentus*
Orchardgrass *Dactylis glomerata*
Pampas *Cortaderia jubata*
Paragrass *Brachiaria mutica*
Phragmites* *Phragmites spp.*
Quackgrass *Agropyron repens*
Redvine* *Brunnichia ovata*
Reed, giant *Arundo donax*
Ryegrass, perennial *Lolium perenne*
Cogongrass *Imperata cylindrica*
Dallisgrass *Paspalum dilatatum*
Dandelion *Taraxacum officinale*
Dock, curly *Rumex crispus*
Dogbane, hemp *Apocynum cannabinum*
Fescues *Festuca spp.*
Fescue, tall *Festuca arundinacea*
Guineagrass *Panicum maximum*
Horsenettle *Solanum carolinense*
Horseradish *Armoracia rusticana*
Johnsongrass *Sorghum halepense*
Smartweed, swamp *Polygonum coccineum*
Spurge, leafy* *Euphorbia esula*
Sweet potato, wild* *Ipomoea pandurata*
Thistle, Canada *Cirsium arvense*
Timothy *Phleum pratense*
Torpedograss* *Panicum repens*
Trumpetcreeper* *Campsis radicans*
Vaseygrass *Paspalum urvillei*
Wheatgrass, western *Agropyron smithii*

*Partial Control

This product is not registered in California for use on water bermudagrass.

See "Directions for Use" and "Mixing, Additives and Application Instructions" sections of this label for labeled uses and specific application instructions.

Alfalfa—Apply 1 quart of this product per acre plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. Make application after the last hay cutting in the fall. Allow alfalfa to regrow to a height of 6 to 8 inches or more prior to treatment.

Applications should be followed with deep tillage at least 7 days after treatment, but before soil freeze-up.

Alligatorweed—Apply 4 quarts of this product per acre or apply a 1½ percent solution with hand-held equipment to provide partial control. Apply when most of the plants are in bloom. Repeat applications will be required to maintain such control.

Bentgrass—For suppression in grass seed production areas. For ground applications only, apply 1.5 quarts of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 10 to 20 gallons of water per acre. Ensure entire crown area has resumed growth prior to a fall application. Bentgrass should be actively growing and have at least 3 inches of growth. Tillage prior to treatment should be avoided. Tillage 7 to 10 days after application is recommended for best results. Failure to use tillage after treatment may result in unacceptable control.

Bermudagrass—For control, apply 5 quarts of this product per acre and, for partial control, apply 3 quarts per acre. Treat when bermudagrass is actively growing and seedheads are present. Retreatment may be necessary to maintain control. Allow 7 or more days after application before tillage.

Bermudagrass, water (knotgrass)—Apply 1.5 quarts of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 5 to 10 gallons of water per acre. Apply when water bermudagrass is actively growing and 12 to 18 inches in length. Allow 7 or more days before tilling, flushing or flooding the field.

Fall applications only—Apply 1 quart of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 5 to 10 gallons of water per acre. Fallow fields should be tilled prior to application. Apply prior to frost on water bermudagrass that is actively growing and 12 to 18 inches in length. Allow 7 or more days before tillage.

Bindweed, field—For control, apply 4 to 5 quarts of this product per acre west of the Mississippi River and 3 to 4 quarts east of the Mississippi River. Apply when the weeds are actively growing and are at or beyond full bloom. Do not treat when weed is under drought stress as good soil moisture is necessary for active growth. For best results, apply in late summer or fall. Fall treatments must be applied before a killing frost. Allow 7 or more days after application before tillage.

Also for control, apply 2 quarts of this product plus 0.5 pound a.i. of Banvel in 10 to 20 gallons of water per acre. At these rates, apply using ground application only.

The following tank mixtures with 2,4-D may be applied using aerial application equipment (except in California) in fallow and reduced tillage systems only.

For suppression on irrigated agricultural land apply 1 to 2 quarts of this product plus 1 pound a.i. of 2,4-D in 10 to 20 gallons of water per acre with ground equipment only. Applications should be made following harvest or on fall fallow ground when the bindweed is actively growing and the majority of runners are 12 inches or more in length. The use of at least one irrigation will promote active bindweed growth.

For suppression, apply 16 fluid ounces of this product plus 0.5 pound a.i. of 2,4-D plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre for ground applications and 3 to 5 gallons of water per acre for aerial applications. Applications should be delayed until maximum emergence has occurred and when vines are between 6 to 18 inches in length.

In California only, apply 1 to 5 quarts of this product per acre. Actual rate needed for suppression or control will vary within this range depending on local conditions. Also, for more specific use recommendations for California refer to the following paragraph:

For suppression on irrigated land where annual tillage is performed, apply 1 quart of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. Apply to actively growing bindweed that has reached a length of 12 inches or greater. Allow maximum weed emergence and runner growth. Do not treat when weed is under drought stress as good soil moisture is necessary for active growth. Allow 3 or more days after application before tillage.

Bluegrass, Kentucky / Bromegrass, smooth / Orchardgrass—Apply 2 quarts of this product in 10 to 40 gallons of water per acre when the grasses are actively growing and most plants have reached boot-to-early seedhead stage of development. For partial control in pasture or hay crop renovation, apply 1 to 1½ quarts of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. Apply to actively growing plants when most have reached 4 to 12 inches in height. Allow 7 or more days after application before tillage.

Orchardgrass (sods going to no-till corn)—Apply 1 to 1 5 quarts of this product per acre plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. Apply to orchardgrass that is a minimum of 12 inches tall for spring applications and 6 inches tall for fall applications. Allow at least three days following application before planting. A sequential application of 3.75 to 4.5 quarts of Lariat® herbicide, or equivalent, will be necessary for optimum results. Lariat should be applied within 3 to 10 days following spring applications to prevent annual weed growth.

Lariat is not registered for use in California.

®Lariat is a registered trademark of Monsanto Company

Bluewood, Texas—Apply 4 to 5 quarts of this product per acre west of the Mississippi River and 3 to 4 quarts per acre east of the Mississippi River. Apply when weed is actively growing and is at or beyond full bloom. Do not treat when weed is under drought stress as good soil moisture is necessary for active growth. New leaf development indicates active growth. For best results, apply in late summer or fall. Fall treatments must be applied before a killing frost. Allow 7 or more days after application before tillage.

Brackenfern—Apply 3 to 4 quarts of this product per acre as a broadcast spray or as a 1 to 1¼ percent solution with hand-held equipment. Apply to fully expanded fronds which are at least 18 inches long.

Bursage, woollyleaf—For control, apply 2 quarts of this product plus 1 pint of Banvel per acre. For partial control, apply 1 quart of this product plus 1 pint of Banvel per acre. Add 0.5 to 1 percent nonionic surfactant by total spray volume and apply 3 to 20 gallons of water per acre. Apply when plants are producing new active growth which has been initiated by moisture for at least 2 weeks and when plants are at or beyond flowering.

Canarygrass, reed / Timothy / Wheatgrass, western — Apply 2 to 3 quarts of this product per acre. For best results, apply to actively growing plants when most have reached the boot-to-head stage of growth. Allow 7 or more days after application before tillage.

Cogongrass—Apply 3 to 5 quarts of this product plus 0.5 to 1 percent nonionic surfactant in 10 to 40 gallons of water per acre. Apply when Cogongrass is at least 18 inches tall and actively growing in late summer or fall. Allow 7 or more days after application before tillage or mowing. Due to uneven stages of growth and the dense nature of vegetation preventing good spray coverage, repeat treatments may be necessary to maintain control.

Dandelion/Dock, curly—Apply 3 to 5 quarts of this product per acre when plants are actively growing and most have reached the early bud stage of growth. Allow 7 or more days after application before tillage.

Also for control, apply 16 fluid ounces of this product plus 0.5 pound a.i. 2,4-D plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre.

Dogbane, hemp—Apply 4 quarts of this product per acre. Apply when actively growing and when most weeds have reached the late bud to flower stage of growth. Following crop harvest or mowing, allow weeds to regrow to a mature stage prior to treatment. For best results, apply in late summer or fall. Allow 7 or more days after application before tillage.

For suppression, apply 16 fluid ounces of this product plus 0.5 pound a.i. of 2,4-D plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre for ground applications and 3 to 5 gallons of water per acre for aerial applications. Delay applications until maximum emergence of dogbane has occurred.

Fescue, tall—Apply 3 quarts of this product in 10 to 40 gallons of water per acre to actively growing plants when most have reached boot-to-early seedhead stage of development.

Fall applications only—Apply 1 quart of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. Apply to fescue in the fall when actively growing and plants have 6 to 12 inches of new growth. Allow 7 or more days after application before tillage. A sequential application of 1 pint per acre of this product plus nonionic surfactant will improve long-term control and control seedlings germinating after fall treatments or the following spring.

Guineagrass—Apply 3 quarts of this product per acre or use a 1 percent solution with hand-held equipment. Apply to actively growing guineagrass when most has reached at least the 7-leaf stage of growth. Ensure thorough coverage when using hand-held equipment. Allow 7 or more days after application before tillage.

Johnsongrass/Ryegrass, perennial—Apply 1 to 3 quarts of this product per acre. In annual cropping systems apply 1 to 2 quarts of this product per acre. Apply 1 quart of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume in 3 to 10 gallons of water per acre. Use 2 quarts of this product when applying 10 to 40 gallons of water per acre. In noncrop or areas where annual tillage (no-till) is not performed, apply 2 to 3 quarts of this product in 10 to 40 gallons of water per acre. For best results, apply to actively growing plants when most have reached the boot-to-head stage of growth or in the fall prior to frost. Allow 7 or more days after application before tillage. Do not tank-mix with residual herbicides when using the 1 quart per acre rate.

For burndown of Johnsongrass, apply 1 pint per acre plus 0.5 to 1 percent nonionic surfactant in 3 to 10 gallons of water per acre before the plants reach a height of 12 inches. For this use, allow at least 3 days after treatment before tillage.

Spot Treatment (partial control or suppression)—Apply a 1 percent solution of this product plus 0.5 to 1 percent nonionic surfactant by total spray volume when johnsongrass is 12 to 18 inches in height. Coverage should be uniform and complete.

Kikuyugrass—Apply 2 to 3 quarts of this product per acre. Spray when most kikuyugrass is at least 8 inches in height (3 or 4-leaf stage of growth) and actively growing. Allow 3 or more days after application before tillage.

Knapweed/Horseradish—Apply 4 quarts of this product per acre. Apply when actively growing and when most weeds have reached the late bud to flower stage of growth. Following crop harvest or mowing, allow weeds to regrow to a mature stage prior to treatment. For best results, apply in late summer or fall. Allow 7 or more days after application before tillage.

Lantana—Apply this product as a 1 to 1¼ percent solution using hand-held equipment only. Apply to actively growing lantana at or beyond the bloom stage of growth. Use the higher application rate for plants that have reached the woody stage of growth. Allow 7 or more days after application before tillage.

Milkweed, common—Apply 3 quarts of this product per acre. Apply when actively growing and most of the milkweed has reached the late bud to flower stage of growth. Following small grain harvest or mowing, allow milkweed to regrow to a mature stage prior to treatment. Allow 7 or more days after application before tillage.

saturated, causing the herbicide to drip on desirable vegetation.

- Mix only the amount of solution to be used during a one-day period, as reduced activity may result from use of leftover solutions. With all equipment, drain and clean sprayer and wiper parts immediately after using this product by thoroughly flushing with water.

RECIRCULATING SPRAYERS

Recirculating sprayer calibration is made on the basis of ground speed and delivery volume. Two procedures can be used to calibrate: (1) determine the discharge being delivered per minute, then operate at the designated ground speed, or (2) select the desired ground speed and then adjust the sprayer to deliver the recommended volume per minute (this may require nozzle changes). Use the appropriate table below.

Do not operate at nozzle pressure above 20 PSI.

Table 1. Use this table when calibrating box or row-type recirculating sprayers. Box or row-type sprayer calibration is based on the total discharge collected per row. Use only straight stream or 15° fan-type nozzles.

*VOLUME PER MINUTE PER ROW	
MPH	Fluid Ounces
2	26 to 35
3	38 to 51
4	51 to 68
5	65 to 86

*NOTE: Be certain the amount collected is for all spray streams treating one row.

Table 2. Use this table when calibrating broadcast type recirculating sprayers. Broadcast recirculating sprayer calibration is based on the discharge collected per minute from one nozzle on a 20-inch spacing.

VOLUME PER MINUTE PER NOZZLE	
MPH	Fluid Ounces
2	7 to 9
3	10 to 13
4	13 to 18
5	16 to 22

When applied as recommended under the conditions described for recirculating sprayers, this product will control the following weeds growing a minimum of 6 inches above desirable vegetation.

Perennial Broadleaf Weeds—To SUPPRESS the following weeds, mix in a ratio of 4 quarts of this product in 20 gallons of water and apply as directed.

Dogbane, hemp *Apocynum cannabinum*
Milkweed *Asclepias syriaca*

Perennial Grasses and Annual Broadleaf Weeds—To control the following weeds, mix in a ratio of 3 quarts of this product in 20 gallons of water and apply as directed:

Cocklebur *Xanthium strumarium*
Pigweed, redroot *Amaranthus retroflexus*
Johnsongrass *Sorghum halepense*
Sunflower *Helianthus annuus*

Annual Grasses—To control the following weeds, mix in a ratio of 2 quarts of this product in 20 gallons of water and apply as directed:

Corn *Zea mays*
Shattercane *Sorghum bicolor*

SHIELDED APPLICATORS

When applied as directed under conditions described for shielded applicators, this product will control those weeds listed in the "Weeds Controlled" section of this label.

Shielded applicators which apply the herbicide solution as a spray band should be calibrated on a broadcast equivalent rate and volume basis. To determine these:

Band width in inches / Row width in inches × Herbicide Broadcast RATE per acre = Herbicide Band RATE per acre

Band width in inches / Row width in inches × Broadcast VOLUME of solution per acre = Band VOLUME of solution per acre

Use nozzles that provide uniform coverage within the treated area. EXTREME CARE MUST BE EXERCISED TO AVOID CONTACT WITH DESIRABLE VEGETATION.

For specific rates of application and instructions for control of various annual and perennial weeds, see the "Weeds Controlled" section of this label.

WIPER APPLICATORS

Wiper applicators include either roller or wick devices which physically wipe appropriate concentrations or amounts of this product directly onto the weed. Equipment must be designed, maintained, and operated to prevent the herbicide solution from contacting desirable vegetation. Operate this equipment at ground speeds no greater than 5 mph. Performance may be improved by reducing speed in areas of heavy weed infestations to ensure adequate wiper saturation. Better results may be obtained if two applications are made in opposite directions.

Do not add surfactant to the herbicide solution.

For Roller Applicators—Mix 1 gallon of this product in enough water to prepare 10 gallons of herbicide solution (10 percent solution). Apply this solution to perennial weeds or annual broadleaf weeds listed in this "Wiper Applicators" section.

Mix 1 gallon of this product in enough water to provide 20 gallons of herbicide solution (5 percent solution). Apply this solution to annual grasses listed in this "Wiper Applicators" section.

Roller speed should be maintained at 40 to 60 RPM.

For Wick or Wiper Applicators—Mix 1 gallon of this product in 2 gallons of water to prepare a 33 percent solution. Apply this solution to weeds listed in this "Wiper Applicators" section.

In severe infestations, reduce equipment ground speed to ensure that adequate amounts of this product are wiped on the weeds. A second treatment in the opposite direction may be beneficial.

Do not permit herbicide solution to contact desirable vegetation.

When applied as recommended under the conditions described for "Wiper Applicators", this product CONTROLS the following weeds:

ANNUAL GRASSES

Corn *Zea mays*
Rye, common *Secale cereale*
Panicum, Texas *Panicum texanum*
Shattercane *Sorghum bicolor*

ANNUAL BROADLEAVES

Sicklepod *Cassia obtusifolia*
Starbur, bristly *Acanthospermum hispidum*
Spanishneedles *Bidens bipinnata*

When applied as recommended under the conditions described for "Wiper Applicators", this product SUPPRESSES the following weeds:

ANNUAL BROADLEAVES

Beggarweed, Florida *Desmodium tortuosum*
Ragweed, giant *Ambrosia trifida*
Dogfennel *Eupatorium capilliflorium*
Sunflower *Helianthus annuus*
Pigweed, redroot *Amaranthus retroflexus*
Thistle, musk *Carduus nutans*
Velvetleaf *Abutilon theophrasti*
Ragweed, common *Ambrosia artemisiifolia*

PERENNIAL GRASSES

Bermudagrass *Cynodon dactylon*
Smutgrass *Sporobolus poiretii*
Guineagrass *Panicum maximum*
Vaseygrass *Paspalum urvillei*
Johnsongrass *Sorghum halepense*

PERENNIAL BROADLEAVES

Dogbane, hemp *Apocynum cannabinum*
Nightshade, silverleaf *Solanum elaeagnifolium*
Milkweed *Asclepias syriaca*
Thistle, Canada *Cirsium arvense*

WEEDS CONTROLLED

This herbicide controls many annual and perennial grasses and broadleaf weeds.

ANNUAL WEEDS

- Apply to actively growing grass and broadleaf weeds.
- Allow at least 3 days after treatment before tillage.
- For maximum agronomic benefit, apply when weeds are 6 inches or less in height.
- To prevent seed production, applications should be made prior to seedhead formation.
- This product does not provide residual control; therefore, delay application until maximum weed emergence. Repeat treatments may be necessary to control later germinating weeds.

LOW-VOLUME BROADCAST APPLICATION (LOW-RATE TECHNOLOGY)

When applied as directed under the conditions described, this product will control the weeds listed below when:

1. Water carrier volumes of 3 to 10 gallons per acre for ground applications and 3 to 5 gallons per acre for aerial applications are recommended. (See the "Aerial Application" section of this label for approved sites.)
2. A nonionic surfactant is added at 0.5 to 1 percent by total spray volume. Use 0.5 percent surfactant concentration when using surfactants which contain at least 70 percent active ingredient or a 1 percent sur-

factant concentration for those surfactants containing less than 70 percent active ingredient.

NOTE

- The addition of 2 percent dry ammonium sulfate by weight or 17 pounds per 100 gallons of water may increase the performance of this product on annual weeds. The improvement in performance may be apparent where environmental stress is a concern. Refer to the "Mixing, Additives and Application Instructions" section of this label.
- Do not tank-mix with soil residual herbicides when using these rates unless otherwise specified.
- For weeds that have been mowed, grazed, or cut, allow regrowth to occur prior to treatment.
- Refer to the "Tank Mixtures" portion of this section for control of additional broadleaf weeds.

WEED SPECIES	MAXIMUM HEIGHT/ LENGTH	RATE PER ACRE** (FLUID OUNCES)
Foxtail *Setaria spp.*	12"	8 oz.
Barnyardgrass *Echinochloa crus-galli*	6" (0 to 4" 4 to 6"	12 oz. 16 oz.[1] 24 oz.[1]
Bluegrass, annual *Poa annua*		
Brome, downy* *Bromus tectorum*		
Mustard, blue *Chorispora tenella*		
Mustard, tansy *Descurainia pinnata*		
Mustard, tumble *Sisymbrium altissimum*		
Mustard, wild *Sinapis arvensis*		
Spurry, umbrella *Holosteum umbellatum*		
Barley *Hordeum vulgare*	12"	
Rye *Secale cereale*		
Sandbur, field *Cenchrus spp.*		
Shattercane *Sorghum bicolor*		
Stinkgrass *Eragrostis cilianensis*		
Wheat *Triticum aestivum*	18"	
Morningglory *Ipomoea spp.*	2"	16 oz.
Sicklepod *Cassia obtusifolia*		
Bluegrass, bulbous *Poa bulbosa*	6"	
Cheat *Bromus secalinus*		
Chickweed, common *Stellaria media*	6"	16 oz.
Chickweed, mouseear *Cerastium vulgatum*		
Corn *Zea mays*		
Goatgrass, jointed *Aegilops cylindrica*		
Groundsel, common *Senecio vulgaris*		
Horseweed/Marestail *Conyza canadensis*		
Lambsquarters, common *Chenopodium album*		
Pennycress, field **Fanweed** *Thlaspi arvense*		
Rocket, London *Sisymbrium irio*		
Ryegrass, Italian *Lolium multiflorum*		
Shepherdspurse *Capsella bursa-pastoris*		
Spurge, annual *Euphorbia spp.*		
Buttercup *Ranunculus spp.*	12"	
Cocklebur *Xanthium strumarium*		
Crabgrass *Digitaria spp.*		
Dwarfdandelion *Krigia cespitosa*		
Falseflax, smallseed *Camelina microcarpa*		
Foxtail, Carolina *Alopecurus carolinianus*		
Johnsongrass, seedling *Sorghum halepense*		
Oats, wild *Avena fatua*		
Panicum, fall *Panicum dichotomiflorum*		
Panicum, Texas *Panicum texanum*		
Pigweed, redroot *Amaranthus retroflexus*		
Pigweed, smooth *Amaranthus hybridus*		
Witchgrass *Panicum capillare*		
Sicklepod *Cassia obtusifolia*	3 to 4"	24 oz
Signalgrass, broadleaf *Brachiaria platyphylla*	4"	
Horseweed/Marestail *Conyza canadensis*	7 to 12"	24 oz
Lambsquarters, common *Chenopodium album*		
Spurge, annual *Euphorbia spp.*		
Rice, red *Oryza sativa*	4"	32 oz.
Teaweed *Sida spinosa*		
Sprangletop *Leptochloa spp.*	6"	
Geranium, Carolina *Geranium carolinianum*	12"	
Goosegrass *Eleusine indica*		
Primrose, cutleaf evening *Oenothera laciniata*		
Pusley, Florida *Richardia scabra*		
Sicklepod *Cassia obtusifolia*	5 to 12"	
Spanishneedles *Bidens bipinnata*		
Filaree *Erodium spp.*	12"	48 oz.
Sprangletop *Leptochloa spp.*		

[1]Use these rates to control barnyardgrass in Alabama, Arkansas, Mississippi, Missouri, Louisiana and Texas for preplant treatments.

*For control in no-till systems, use 16 fluid ounces per acre.

**For those rates less than 32 fluid ounces per acre, this product at rates up to 32 fluid ounces per acre may be used where heavy weed densities exist.

TANK MIXTURES

ROUNDUP® plus BANVEL plus NONIONIC SURFACTANT

ROUNDUP plus 2,4-D plus NONIONIC SURFACTANT

DO NOT APPLY BANVEL OR 2,4-D TANK MIXTURES BY AIR IN CALIFORNIA.

These tank mixtures are recommended for use in fallow and reduced tillage areas only. Follow use directions as given in the "Low-Volume Broadcast Application" section.

This product plus Banvel or 2,4-D will control the [illegible] grasses and broadleaf weeds previously listed for this product alone at the indicated heights (except 8 fluid ounces per acre applications), plus the following broadleaf weeds. For those weeds previously listed at 8 fluid ounces of this product alone per acre, use 12 fluid ounces in these tank mixtures.

weed control may result. Reduced results may also occur when treating weeds heavily covered with dust.

Reduced control may result when applications are made to annual or perennial weeds that have been mowed, grazed, or cut, and have not been allowed to regrow to the recommended stage for treatment.

Rainfall or irrigation occurring within 6 hours after application may reduce effectiveness. Heavy rainfall or irrigation within 2 hours after application may wash the chemical off the foliage and a repeat treatment may be required.

This product does not provide residual weed control. For subsequent residual weed control, follow a label-approved herbicide program. Read and carefully observe the cautionary statements and all other information appearing on the labels of all herbicides used.

Buyer and all users are responsible for all loss or damage in connection with the use or handling of mixtures of this product with herbicides or other materials that are not expressly recommended in this labeling. Mixing this product with herbicides or other materials not recommended on this label may result in reduced performance.

For best results, spray coverage should be uniform and complete. Do not spray weed foliage to the point of runoff.

Keep people and pets off treated areas until spray solution has dried.

DOMESTIC ANIMALS: This product is considered to be relatively nontoxic to dogs and other domestic animals; however, ingestion of this product or large amounts of freshly sprayed vegetation may result in temporary gastrointestinal irritation (vomiting, diarrhea, colic, etc.). If such symptoms are observed, provide the animal with plenty of fluids to prevent dehydration. Call a veterinarian if symptoms persist for more than 24 hours.

ATTENTION

AVOID DRIFT. EXTREME CARE MUST BE USED WHEN APPLYING THIS PRODUCT TO PREVENT INJURY TO OESIRABLE PLANTS AND CROPS.

Do not allow the herbicide solution to mist, drip, drift, or splash onto desirable vegetation since minute quantities of this product can cause severe damage or destruction to the crop, plants, or other areas on which treatment was not intended. The likelihood of injury occurring from the use of this product is greatest when winds are gusty or in excess of 5 miles per hour or when other conditions, including lesser wind velocities, will allow spray drift to occur. When spraying, avoid combinations of pressure and nozzle type that will result in splatter or fine particles (mist) which are likely to drift. AVOID APPLYING AT EXCESSIVE SPEED OR PRESSURE.

NOTE: Use of this product in any manner not consistent with this label may result in injury to persons, animals or crops, or other unintended consequences. Keep container closed to prevent spills and contamination.

MIXING, ADDITIVES AND APPLICATION INSTRUCTIONS

APPLY THESE SPRAY SOLUTIONS IN PROPERLY MAINTAINED AND CALIBRATED EQUIPMENT CAPABLE OF DELIVERING DESIRED VOLUMES. DO NOT APPLY WHEN WIND OR OTHER CONDITIONS FAVOR DRIFT. HAND GUN APPLICATIONS SHOULD BE PROPERLY DIRECTED TO AVOID SPRAYING DESIRABLE PLANTS. NOTE: REDUCED RESULTS MAY OCCUR IF WATER CONTAINING SOIL IS USED, SUCH AS WATER FROM PONDS AND UNLINED DITCHES.

MIXING

This product mixes readily with water. Mix spray solutions of this product as follows: Fill the mixing or spray tank with the required amount of water. Add the recommended amount of this product (see the "Directions for Use" and "Weeds Controlled" sections of this label) near the end of the filling process and mix well. Remove hose from tank immediately after filling to avoid siphoning back into the carrier source. During mixing and application, foaming of the spray solution may occur. To prevent or minimize foam, avoid the use of mechanical agitators, terminate by-pass and return lines at the bottom of the tank and, if needed, use an approved anti-foam or defoaming agent.

TANK MIXTURES

Always predetermine the compatibility of labeled tank mixtures of this product with water carrier by mixing small proportional quantities in advance.

Mix labeled tank mixtures of this product with water as follows:

1. Place a 20 to 35 mesh screen or wetting basket over filling port.
2. Through the screen, fill the sprayer tank one-half full with water and start agitation.
3. If a wettable powder is used, make a slurry with the water carrier, and add it SLOWLY through the screen into the tank. Continue agitation.
4. If a flowable formulation is used, premix one part flowable with one part water. Add diluted mixture SLOWLY through the screen into the tank. Continue agitation.
5. If an emulsifiable concentrate formulation is used, premix one part emulsifiable concentrate with two parts water. Add diluted mixture slowly through the screen into the tank. Continue agitation.
6. Continue filling the sprayer tank with water and add the required amount of this product near the end of the filling process.
7. Where nonionic surfactant is recommended, add this to the spray tank before completing the filling process.
8. Add individual formulations to the spray tank as follows: wettable powder, flowable, emulsifiable concentrate, drift control additive, water soluble liquid followed by surfactant.

Maintain good agitation at all times until the contents of the tank are sprayed. If the spray mixture is allowed to settle, thorough agitation is required to resuspend the mixture before spraying is resumed.

Keep by-pass line on or near bottom of tank to minimize foaming. Screen size in nozzle or line strainers should be no liner than 50 mesh. Carefully select proper nozzle to avoid spraying a fine mist. For best results with conventional ground applications equipment, use flat fan nozzles.

Clean sprayer and parts immediately after using this product by thoroughly flushing with water.

ADDITIVES

SURFACTANTS

Nonionic surfactants which are labeled for use with herbicides may be used. Do not reduce rates of this product when adding surfactant. When adding additional surfactant, use 0.5 percent surfactant concentration (2 quarts per 100 gallons of spray solution) when using surfactants which contain at least 70 percent active ingredient or a 1 percent surfactant concentration (4 quarts per 100 gallons of spray solution) for those surfactants containing less than 70 percent active ingredient. Read and carefully observe surfactant cautionary statements and other information appearing on the surfactant label.

AMMONIUM SULFATE

The addition of 1 to 2 percent dry ammonium sulfate by weight or 8.5 to 17 pounds per 100 gallons of water may increase the performance of this product, and this product plus 2,4-D, Banvel™ or residual herbicide tank mixtures on annual and perennial weeds. The improvement in performance may be apparent where environmental stress is a concern. Low quality ammonium sulfate may contain material that will not readily dissolve which could result in nozzle tip plugging. To determine quality, perform a jar test by adding ½ cup of ammonium sulfate to 1 gallon of water and agitate for 1 minute. If undissolved sediment is observed, predissolve the ammonium sulfate in water and filter prior to addition to the spray tank. If ammonium sulfate is added directly to the spray tank, add slowly with agitation. Adding too quickly may clog outlet line. Ensure that ammonium sulfate is completely dissolved in the spray tank before adding herbicides or surfactant. Thoroughly rinse the spray system with clean water after use to reduce corrosion.

NOTE: The use of ammonium sulfate as an additive does not preclude the need for additional surfactant. Do not use herbicide rates lower than recommended in this label.

™Banvel is a trademark of Sandoz, Inc.

COLORANTS OR DYES

Agriculturally approved colorants or marking dyes may be added to this product. Colorants or dyes used in spray solutions of this product may reduce performance, especially at lower rates or dilutions. Use colorants or dyes according to the manufacturer's recommendations.

APPLICATION EQUIPMENT AND TECHNIQUES

Do not apply this product through any type of irrigation system.

This product may be applied with the following application equipment:

Aerial—Fixed Wing and Helicopter

Broadcast Spray

Controlled Droplet Applicator (CDA)—Hand-held or boom-mounted applicators which produce a spray consisting of a narrow range of droplet sizes.

Hand-Held and High-Volume Spray Equipment—Knapsack and backpack sprayers, pump-up pressure sprayers, handguns, handwands, lances and other hand-held spray equipment used to direct the spray onto weed foliage and vehicle-mounted high-volume spray equipment for spray-to-wet applications.

Selective equipment—Recirculating sprayers, shielded sprayers and wiper applicators.

See the appropriate part of this section for specific rates of application and instructions.

AERIAL EQUIPMENT

Use the recommended rates of this herbicide in 3 to 15 gallons of water per acre unless otherwise specified on this label. See the "Weeds Controlled" section of this label for specific rates. Unless otherwise specified, do not exceed one quart per acre. **(Aerial applications of this product may be made in annual cropping conventional tillage systems, fallow and reduced tillage systems, pre-harvest, silvicultural sites, and rights-of-way. Refer to the individual use area sections of this label for recommended volumes and application rates.) FOR AERIAL APPLICATION IN CALIFORNIA, REFER TO THE FEDERAL SUPPLEMENTAL LABEL FOR AERIAL APPLICATIONS IN THAT STATE FOR SPECIFIC INSTRUCTIONS, RESTRICTIONS AND REQUIREMENTS.**

This product plus Oust tank mixtures may not be applied by air in California.

Avoid direct application to any body of water.

AVOID DRIFT—DO NOT APPLY DURING INVERSION CONDITIONS, WHEN WINDS ARE GUSTY, OR UNDER ANY OTHER CONDITION WHICH FAVORS DRIFT. DRIFT MAY CAUSE DAMAGE TO ANY VEGETATION CONTACTED TO WHICH TREATMENT IS NOT INTENDED. TO PREVENT INJURY TO ADJACENT DESIRABLE VEGETATION, APPROPRIATE BUFFER ZONES MUST BE MAINTAINED.

Coarse sprays are less likely to drift; therefore, do not use nozzles or nozzle configurations which dispense spray as fine spray droplets. Do not angle nozzles forward into the airstream and do not increase spray volume by increasing nozzle pressure.

Drift control additives may be used. When a drift control additive is used, read and carefully observe the cautionary statements and all other information appearing on the additive label.

Ensure uniform application—To avoid streaked, uneven or overlapped application, use appropriate marking devices.

Thoroughly wash aircraft, especially landing gear, after each day of spraying to remove residues of this product accumulated during spraying or from spills. PROLONGED EXPOSURE OF THIS PRODUCT TO UNCOATED STEEL SURFACES MAY RESULT IN CORROSION AND POSSIBLE FAILURE OF THE PART. LANDING GEAR ARE MOST SUSCEPTIBLE. The maintenance of an organic coating (paint) which meets aerospace specification MIL-C-38413 may prevent corrosion.

BROADCAST EQUIPMENT

For control of annual or perennial weeds listed on this label using broadcast equipment—Use the recommended rates of this product in 3 to 40 gallons of water per acre as a broadcast spray unless otherwise specified on this label. See the "Weeds Controlled" section of this label for specific rates. As density of weeds increases, spray volume should be increased within the recommended range to ensure complete coverage. Carefully select proper nozzle to avoid spraying a fine mist. For best results with ground application equipment, use flat fan nozzles. Check for even distribution of spray droplets

CONTROLLED DROPLET APPLICATION (CDA)

The rate of this product applied per acre by vehicle-mounted CDA equipment must not be less than the amount recommended in this label when applied by conventional broadcast equipment. For vehicle-mounted CDA equipment, apply 3 to 15 gallons of water per acre.

For the control of labeled annual weeds with hand-held CDA units, apply a 20 percent solution of this product at a flow rate of 2 fluid ounces per minute and a walking speed of 1.5 MPH (1 quart per acre). For the control of labeled perennial weeds, apply a 20 to 40 percent solution of this product at a flow rate of 2 fluid ounces per minute and a walking speed of 0.75 MPH (2 to 4 quarts per acre).

Controlled droplet application equipment produces a spray pattern which is not easily visible. Extreme care must be exercised to avoid spray or drift contacting the foliage or any other green tissue of desirable vegetation, as damage or destruction may result.

HAND-HELD and HIGH-VOLUME EQUIPMENT

Use coarse sprays only.

Mix this product in clean water and apply to foliage of vegetation to be controlled. For applications made on a spray-to-wet basis, spray coverage should be uniform and complete. Do not spray to the point of runoff.

For control of annual weeds listed on this label, apply a 0.5 percent solution of this product plus nonionic surfactant to weeds less than 6 inches in height or runner length. Apply prior to seedhead formation in grass or bud formation in broadleaf weeds. Allow three or more days before tillage or mowing.

For annual weeds over 6 inches tall, or when not using additional surfactant, or unless otherwise specified, use a 1 percent solution. For best results, use a 2 percent solution on harder-to-control perennials, such as bermudagrass, dock, field bindweed, hemp dogbane, milkweed and Canada thistle.

Less than complete coverage of weeds may result from the use of spray equipment designed for motorized spot treatments. Where less than complete coverage of annual weeds occurs, use a 5 percent solution. Do not reduce recommended concentrations of this product when adding surfactant.

Prepare the desired volume of spray solution by mixing the amount of this product in water as shown in the following table.

Spray Solution

DESIRED VOLUME	AMOUNT OF ROUNDUP®				
	½%	1%	1½%	2%	5%
1 gallon	⅔ oz	1½ oz	2 oz	2½ oz	6½ oz
25 gallons	1 pt	1 qt	1½ qt	2 qt	5 qt
100 gallons	2 qt	1 gal	1½ gal	2 gal	5 gal

2 tablespoons = 1 fluid ounce

For use in knapsack sprayers, it is suggested that the proper amount of this product be mixed with water in a larger container. Fill sprayer with the mixed solution.

For hand-held WIPER APPLICATORS, see the "Selective Equipment" section and for hand-held CONTROLLED DROPLET APPLICATORS, see the "Controlled Droplet Application (CDA)" section of this label.

SELECTIVE EQUIPMENT

This product may be applied through a recirculating spray system, a shielded applicator, or a wiper applicator after dilution and thorough mixing with water to listed weeds growing in any noncrop site specified on this label and only when specifically recommended in cropping systems.

A recirculating spray system directs the spray solution onto weeds growing above desirable vegetation while spray solution not intercepted by weeds is collected and returned to the spray tank for reuse.

A shielded applicator directs the herbicide solution onto weeds while shielding desirable vegetation from the herbicide.

A wiper applicator applies the herbicide solution onto weeds by rubbing the weed with an absorbent material containing the herbicide solution.

AVOID CONTACT WITH DESIRABLE VEGETATION.

Contact of the herbicide solution with the desirable vegetation may result in damage or destruction. Applicators used above desired vegetation should be adjusted so that the lowest spray stream or wiper contact point is at least two inches above the desirable vegetation. Droplets, mist, foam, or splatter of the herbicide solution settling on desirable vegetation may result in discoloration, stunting, or destruction.

Applications made above the crops should be made when the weeds are a minimum of 6 inches above the desirable vegetation. Better results may be obtained when more of the weed is exposed to the herbicide solution. Weeds not contacted by the herbicide solution will not be affected. This may occur in dense clumps, severe infestations, or when the height of the weeds varies so that not all weeds are contacted. In these instances, repeat treatment may be necessary.

See the "Weeds Controlled" section of this label for recommended stage of growth for specific weeds.

NOTE

- Maintain equipment in good operating condition. Avoid leakage or dripping onto desirable vegetation.
- Adjust height of applicator to insure adequate contact with weeds.
- Keep nozzle tips and wiping surfaces clean.
- Keep spray patterns aligned into recovery chamber of the recirculating sprayer.
- Keep shields on shielded applicators adjusted to protect desirable vegetation.
- Maintain recommended roller RPM on roller applicators while in use.
- Keep wiper material at proper degree of saturation with herbicide solution.
- DO NOT use wiper equipment when weeds are wet.
- DO NOT operate equipment at ground speeds greater than 5 mph. Weed control may be affected by speed of application equipment. As weed density increases, reduce equipment ground speed to ensure good coverage of weeds.
- Be aware that, on sloping ground, the herbicide solution may migrate, causing dripping on the lower end and drying on the upper end of a wiper applicator.
- Variation in equipment design may affect weed control. With wiper applicators, the wiping material and its orientation must allow delivery of sufficient quantities of the recommended herbicide solution directly to the weed.
- Care must be taken with all types of wipers to ensure that the absorbent material does not become over-

SPILL, LEAK & DISPOSAL INFORMATION

SPILL/LEAK:

Observe all protection and safety precautions when cleaning up spills – see Occupational Control Procedures.

Liquid spills on floor or other impervious surfaces should be contained or diked, and should be absorbed with attapulgite, bentonite or other absorbent clays. Collect contaminated absorbent, place in plastic-lined metal drum and dispose of in accordance with instructions provided under DISPOSAL. Thoroughly scrub floor with a strong industrial type detergent solution and rinse with water.

Liquid spills that soak into the ground should be dug-up, placed in plastic-lined metal drums and disposed of in accordance with instructions provided under DISPOSAL.

Leaking containers should be separated from non-leakers and either the container or its contents transferred to a plastic-lined drum or other non-leaking container. Dispose of leaking container in accordance with instructions provided under DISPOSAL. Any recovered spilled liquid should be similarly collected and disposed of.

Do not contaminate water, foodstuffs, feed or seed by storage or disposal.

DISPOSAL:

Wastes resulting from the use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, state or local procedures.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed. DO NOT CUT OR WELD ON OR NEAR THIS CONTAINER.

Metal Drums:	Triple rinse container. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.
Metal Bulk:	Triple rinse emptied bulk containers. Then offer for recycling or reconditioning or disposal in a manner approved by state and local authorities.
Plastic Drums and mini bulk:	Do not reuse container. Return container per the Monsanto container return program. If not returned, triple rinse container, then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed, by state and local authorities, by burning. If burned, stay out of smoke.

DATE: November, 1992 **SUPERSEDES:** February, 1992 **MSDS NO.:** S00012114 (previously M00007588)

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CALL: 1-800-332-3111

This sample label is current as of March 1, 1992. The product descriptions and recommendations provided in this sample label are for background information only. Always refer to the label on the product container before using Monsanto or any other agrichemical product.

Complete Direct

EPA Reg. No. 524-445

AVOID CONTACT WITH FOLIAGE, GREEN STEMS, OR FRUIT OF CROPS, DESIRABLE PLANTS AND TREES, SINCE SEVERE INJURY OR DESTRUCTION MAY RESULT.

*** Roundup is a registered trademark of Monsanto Company.**

This product has been approved for use in California except as stated otherwise on page 121.

1992-2 **898.07-000.01/CG**

Read the entire label before using this product.

Use only according to label instructions.

Read "LIMIT OF WARRANTY AND LIABILITY" before buying or using. If terms are not acceptable, return at once unopened.

REFORMULATION IS PROHIBITED. SEE INDIVIDUAL CONTAINER LABEL FOR REPACKAGING LIMITATIONS.

LIMIT OF WARRANTY AND LIABILITY

(Not applicable to consumer applications applied by the homeowner for noncommercial purposes as permitted by the supplemental labeling for one-quart containers.)

This Company warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes set forth in the Complete Directions for Use label booklet ("Directions") when used in accordance with those Directions under the conditions described therein. NO OTHER EXPRESS WARRANTY OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE OR MERCHANTABILITY IS MADE. This warranty is also subject to the conditions and limitations stated herein.

Buyer and all users shall promptly notify this Company of any claims whether based in contract, negligence, strict liability, other tort or otherwise.

Buyer and all users are responsible for all loss or damage from use or handling which results from conditions beyond the control of this Company, including, but not limited to, incompatibility with products other than those set forth in the Directions, application to or contact with desirable vegetation, unusual weather, weather conditions which are outside the range considered normal at the application site and for the time period when the product is applied, as well as weather conditions which are outside the application ranges set forth in the Directions, application in any manner not explicitly set forth in the Directions, moisture conditions outside the moisture range specified in the Directions, or the presence of products other than those set forth in the Directions in or on the soil, crop or treated vegetation.

THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE LIMIT OF THE LIABILITY OF THIS COMPANY OR ANY OTHER SELLER FOR ANY AND ALL LOSSES, INJURIES OR DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT (INCLUDING CLAIMS BASED IN CONTRACT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE) SHALL BE THE PURCHASE PRICE PAID BY THE USER OR BUYER FOR THE QUANTITY OF THIS PRODUCT INVOLVED, OR, AT THE ELECTION OF THIS COMPANY OR ANY OTHER SELLER, THE REPLACEMENT OF SUCH QUANTITY, OR, IF NOT ACQUIRED BY PURCHASE, REPLACEMENT OF SUCH QUANTITY. IN NO EVENT SHALL THIS COMPANY OR ANY OTHER SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES.

Buyer and all users are deemed to have accepted the terms of this LIMIT OF WARRANTY AND LIABILITY which may not be varied by any verbal or written agreement.

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

Keep out of reach of children.

WARNING!

CAUSES SUBSTANTIAL BUT TEMPORARY EYE INJURY.

HARMFUL IF INHALED.

Do not get in eyes or breathe spray mist or get in or on clothing.

Wear goggles, face shield or safety glasses.

Wash thoroughly with soap and water after handling.

Remove contaminated clothing and wash before reuse.

FIRST AID: IF IN EYES, hold eyelids open and flush with plenty of water. Get medical attention.

IF INHALED, remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

IF SWALLOWED, drink promptly a large quantity of milk, egg whites, or gelatin solution. If these are not available drink large quantities of water. Get medical attention.

In case of an emergency involving this product, Call Collect, day or night, (314) 694-4000.

Environmental Hazards

Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwaters.

Physical or Chemical Hazards

Spray solutions of this product should be mixed, stored and applied using only stainless steel, aluminum, fiberglass, plastic or plastic-lined steel containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED STEEL OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

ACTIVE INGREDIENT:	
*Glyphosate, N-(phosphonomethyl) glycine, in the form of its isopropylamine salt	41.0%
INERT INGREDIENTS:	59.0%
	100.0%

*Contains 480 grams per litre or 4 pounds per U.S. gallon of the active ingredient, glyphosate, in the form of its isopropylamine salt. Equivalent to 356 grams per litre or 3 pounds per U.S. gallon of the acid, glyphosate.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in any manner inconsistent with its labeling.

Storage and Disposal

Do not contaminate water, foodstuffs, feed or seed by storage or disposal.

See container label for STORAGE AND DISPOSAL instructions.

GENERAL INFORMATION

DO NOT APPLY THIS PRODUCT USING AERIAL SPRAY EQUIPMENT EXCEPT UNDER CONDITIONS AS SPECIFIED WITHIN THIS LABEL.

This product, a water soluble liquid, mixes readily with water to be applied as a foliar spray for the control or destruction of most herbaceous plants. It may be applied through most standard industrial or field-type sprayers after dilution and thorough mixing with water in accordance with label instructions.

This product moves through the plant from the point of foliage contact to and into the root system. Visible effects on most annual weeds occur within 2 to 4 days, but on most perennial weeds may not occur for 7 days or more. Extremely cool or cloudy weather following treatment may slow activity of this product and delay visual effects of control. Visible effects are a gradual wilting and yellowing of the plant which advances to complete browning of aboveground growth and deterioration of underground plant parts.

Unless otherwise specified on this label, delay application until vegetation has emerged and reached the stages described for control of such vegetation under the "Weeds Controlled" section of this label. Unemerged plants arising from unattached underground rhizomes or root stocks of perennials will not be affected by the herbicide and will continue to grow. For this reason, best control of most perennial weeds is obtained when treatment is made at late growth stages approaching maturity.

Always use the higher rate of this product per acre within the recommended range when (1) weed growth is heavy or dense, or (2) weeds are growing in an undisturbed (noncultivated) area.

Do not treat weeds under poor growing conditions such as drought stress, disease or insect damage, as reduced

EMERGENCY AND FIRST AID PROCEDURES

FIRST AID:

If In Eyes: Hold eyelids open and flush with plenty of water. Get medical attention.

If Swallowed: Drink promptly a large quantity of milk, egg whites, or gelatin solution. If these are not available, drink large quantities of water. Get medical attention.

If Inhaled: Remove victim to fresh air. If not breathing, give artificial respiration, preferaoly mouth-to-mouth. Get medical attention.

NOTE: For additional human emergency first aid or treatment guidance, call collect, anytime, day or night (314) 694-4000.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical splash goggles during mixing/pouring operations or other activities in which eye contact with undiluted ROUNDUP® herbicide is likely to occur.

Skin Protection: ROUNDUP® herbicide does not present significant skin concern requiring special protection.

Respiratory Protection: For Handling of the Undiluted Product: Undiluted ROUNDUP® herbicide is not likely to present an airborne exposure concern during normal handling. In the event of an accidental discharge of the material during manufacture or handling which produces a heavy vapor or mist, workers should put on respiratory protection equipment. Consult respirator manufacturer to determine appropriate type of equipment. Observe respirator use limitations specified by NIOSH/MSHA or the manufacturer.

For Application of Product Diluted in accordance with label instructions: Respirators are not required for applications of use - dilutions of ROUNDUP® herbicide.

Ventilation: No special precautions are recommended.

Airborne Exposure Limits:

Product: **ROUNDUP® herbicide - 100% by wt.:**
OSHA PEL: None established ACGIH TLV: None established

Ethoxylated Tallowamine:
OSHA PEL: None established ACGIH TLV: None established

FIRE PROTECTION INFORMATION

Flash Point: >200°F **Method:** Pensky-Martens

Extinguishing Media: Water spray, foam, dry chemical, CO_2, or any class B extinguishing agent.

Special Firefighting Procedures: Firefighters or others who may be exposed to vapors, mists or products of combustion should wear a self-contained breathing apparatus. Equipment should be thoroughly cleaned after use.

Unusual Fire and Explosion Hazards: None

REACTIVITY DATA

Stability: Stable for at least 5 years under normal conditions of warehouse storage.

Incompatibility: Spray solutions of this product should be mixed, stored or applied using only stainless steel, aluminum, fiberglass, plastic or plastic-lined containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

Hazardous Decomposition Products: None

Hazardous Polymerization: Does not occur. This product can react with caustic (basic) materials to liberate heat. This is not a polymerization but rather a chemical neutralization in an acid base reaction.

HEALTH EFFECTS SUMMARY

The following information summarizes human experience and results of scientific investigations reviewed by health professionals for hazard evaluation of ROUNDUP® herbicide and development of Precautionary Statements and Occupational Control Procedures recommended in this document.

EFFECTS OF EXPOSURE

Skin contact and inhalation are expected to be the primary routes of occupational exposure to ROUNDUP® herbicide. Although limited occupational exposure to this material has not been reported to produce significant adverse health effects, ROUNDUP® herbicide is considered, on the basis of single exposure (acute) animal tests, to be slightly to moderately irritating to eyes. Ingestion of similar formulations has been reported to produce gastrointestinal discomfort with irritation of the mouth, nausea, vomiting and diarrhea. Oral ingestion of large quantities of one similar product has been reported to result in hypotension and lung edema.

TOXICOLOGICAL DATA

Data from laboratory studies conducted by Monsanto with ROUNDUP® herbicide are summarized below:

Single exposure (acute) studies indicate:

Oral -	Practically non-toxic, (Rat LD_{50}, >5,000 mg/Kg)
Dermal -	Practically non-toxic, (Rabbit LD_{50}, >5000 mg/Kg)
Inhalation -	Slightly toxic, (Rat 4-hr LC_{50}, - 2.6 mg/L)
Eye Irritation -	Slightly to moderately irritating, (Rabbit)
Skin Irritation -	Essentially non-irritating (Rabbit, 4 hr. exposure)

No skin allergy was observed in guinea pigs following repeated skin exposure.

COMPONENTS

Data from laboratory studies conducted by Monsanto and from the scientific literature on components of ROUNDUP® herbicide:

Isopropylamine Salt of Glyphosate

Data from studies with a formulation comprised of 62% isopropylamine salt of glyphosate (MON 0139) indicate the following:

In repeat dosing studies (6-month), dogs fed MON 0139 exhibited slight body weight changes. Following repeated skin exposure (3-week) to MON 0139, skin irritation was the primary effect in rabbits.

Additional toxicity information is available on glyphosate, the active herbicidal ingredient of MON 0139. Following repeated exposures (90-days) to glyphosate in their feed, decreased weight gains were noted at the highest test level in mice, while no treatment-related effects occurred in rats. Following repeated skin exposure (3 weeks) to glyphosate, slight skin irritation was the primary effect observed in rabbits. No skin allergy was observed in guinea pigs following repeated skin exposure. There was no evidence of effects on the nervous system, including delayed effects in chickens (repeat oral doses) or cholinesterase inhibition in rats (single oral doses). Reduced body weight gain and effects on liver tissues were observed with long-term (2-year) feeding of glyphosate to mice at high-dose levels. Reduced body weight gain and eye changes were observed at the high-dose level in one long-term (2 year) feeding study with rats, while no treatment-related effects occurred in a second study. No adverse effects were observed in feeding studies with dogs. Glyphosate did not produce tumors in any of these studies. **Based on the results from the chronic studies, EPA has classified glyphosate in category E (evidence of non-carcinogenicity for humans).** No birth defects were noted in rats and rabbits given glyphosate orally during pregnancy, even at amounts which produced adverse effects on the mothers. Glyphosate was fed continuously to rats at very high dose levels for 2 successive generations. Toxicity was reported in offspring from the high dose, a level which also produced adverse effects on the mothers. In a 3 generation study conducted at lower dose levels, no effects were seen on the ability of male or female rats to reproduce. Glyphosate has produced no genetic changes in a variety of standard tests using animals and animal or bacterial cells.

Ethoxylated Tallowamine

The surfactant component of ROUNDUP® herbicide is reported to cause irritation to the eyes and skin and may contribute to the irritation potential reported for this herbicide. Ingestion may produce gastrointestinal irritation, nausea, vomiting and diarrhea.

PHYSICAL DATA

Appearance:	clear, viscous amber-colored solution
Odor:	practically odorless to slight amine-like odor
pH:	4.7 (1% solution)
Specific Gravity:	1.17 (Water = 1)

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

ADDITIONAL REGULATORY INFORMATION

SARA Title III Data

Section 311 and 312 Hazard Categories

Immediate Health Hazard - Y
Delayed Health Hazard - N
Fire Hazard - N
Reactive Hazard - N
Sudden Pressure Release Hazard - N

Section 302 Extremely Hazardous Substances - None

Section 313 Toxic Chemicals - None

CERCLA Reportable Quantity

None

APPENDIX

The information and statements herein are believed to be reliable but are not to be construed as a warranty or representation for which we assume legal responsibility. Users should undertake sufficient verification and testing to determine the suitability for their own particular purpose of an information or products referred to herein. NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE IS MADE.

SOURCE AND DATE INFORMATION SHEET NO.: AG09107-1
DATE: OCT 05, 1992

MONSANTO PRODUCT NAME
ROUNDUP® HERBICIDE

MONSANTO COMPANY
800 N. LINDBERGH
ST. LOUIS, MO 63167
EMERGENCY PH. NO. (CALL COLLECT) (314) 694-4000
DATE PREPARED: November, 1992

PRODUCT IDENTIFICATION

EPA Registration Number:	524-445
Synonyms:	None
Chemical Name:	Not Applicable, Formulated Product
Active Ingredient:	*Glyphosate, N-(phosphonomethyl) glycine, in the form of its isopropylamine salt 41.0%
Inert Ingredients:	..... 59.0%
	100.0%
	*Contains 480 grams per liter or 4 pounds per gallon of the active ingredient glyphosate in the form of its isopropylamine salt. Equivalent to 356 grams per liter or 3 pounds per U.S. gallon of the acid, glyphosate.
CAS Reg. No.:	Not Applicable, Formulated Product
CAS Reg. No. Active Ingredient:	1071-83-6
DOT Proper Shipping Name:	Not Applicable
DOT Hazard Class/I.D. No.:	Not Applicable
DOT Label:	Not Applicable
Reportable Quantity (RQ) Under CERCLA:	Not Applicable
U.S. Surface Freight Classification:	Weed killing compound, N.O.I.B.N.

SARA Hazard Notification
Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): Immediate

Section 313 Toxic Chemical(s): Not Applicable

Hazardous Chemical(s) Under OSHA Hazard Communication Standard:
This product contains, as components, the substances listed below which are identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR §1910.1200):
Ethoxylated Tallowamines, CAS Reg. No. 61791-26-2

WARNING STATEMENTS

Keep out of reach of children.
WARNING!
CAUSES SUBSTANTIAL BUT TEMPORARY EYE INJURY
HARMFUL IF INHALED
REFORMULATION IS PROHIBITED
SEE INDIVIDUAL CONTAINER LABEL FOR REPACKAGING LIMITATIONS

PRECAUTIONARY MEASURES

- Do not get in eyes or breathe spray mist or get in or on clothing.
- Wear goggles, face shield or safety glasses.
- Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.
- Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark.
- Do not contaminate water when disposing of equipment washwaters.

(cont from pg. 2) ACUTE TOXICITY DATA:
Toxicological data on this particular formulation is not available. How-ever, data from a similar formulation product have shown the following;

The acute oral LD_{50} for both male and female albino rats is greater than 5000 mg/kg indicating that this material is no more than slightly toxic if ingested.

The acute dermal LD_{50} for both male and female albino rabbits is greater than 2148 mg/kg indicating that this material is no more than slightly toxic by single skin applications.

This formulation may be irritating to the rabbit eye and mildly irritating to the rabbit skin.

CHRONIC TOXICITY DATA:
Mutagenicity: No mutagenic activity was observed in ARSENAL Technical (Imazapyr) by all test methods used. These included unscheduled DNA Synthesis Rat Hepatocyte Assay, in vitro Chinese Hamster Ovary (CHO)/Hypoxanthine Guanine Phoshporiboxyl Transferase (HGPRT) Mutation Assay Bacterial/Microsome Reverse Mutation (Ames) Test and in vitro Chromosomal Aberrations in Chinese Hamster Ovary Cells.

Teratogenicity: No teratogenic or fetotoxic effects were found at all dose levels tested in mice and rats.

Imazapyr is not listed as a human carcinogen by the IARC, OSHA or NTP.

Isopropylamine salt present in this formulation is not listed as a human carcinogen by the IARC, OSHA or NTP.

EMERGENCY AND FIRST AID PROCEDURES:

IF ON SKIN: Wash skin with plenty of soap and water. Get medical attention if irritation persists.

IF IN EYES: Flush eyes with plenty of water. Get medical attention if irritation persists.

IF SWALLOWED: Drink two glasses of water, induce vomiting if the person is conscious. Obtain medical attention promptly.

IF INHALED: Remove subject to fresh air.

NOTES TO PHYSICIAN:
There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition.

(cont from pg. 3) MEDICAL CONDITION AGGRAVATED BY OVEREXPOSURE: A knowledge of the available toxicology information a[illegible] o[illegible] the physical and chemical properties of the material suggests that overexposure is unlikely to aggravate existing medical conditions.

EXPOSURE CONTROL METHODS

During formulation of this product, use the following recommended industrial hygiene practices:

Wear chemical splash goggles to prevent contact with the skin. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

For end-users, refer to product label for personal protective clothing/equipment if required.

SPILL OR LEAK PROCEDURES

Absorb with an inert material such as clay or sawdust. Place in a closed container for disposal.

WASTE DISPOSAL: Dispose in accord with local, state, and federal regulations. Imazapyr is not a RCRA hazardous waste.

SPECIAL PRECAUTIONS

HANDLING AND STORAGE:
Do not contaminate water, food, or feed by storage or disposal. Store in a secure, dry, well-ventilated, separate room, building or covered area.

Not for use or storage in or around the home.

Keep away from sources of ignition and protect from exposure to fire and heat.

Segregate from oxidizers and incompatible materials listed in the Reactivity Data Section.

AMERICAN CYANAMID CO.
WAYNE, NJ 07470

MATERIAL SAFETY DATA SHEET

MSDS NO. AG09107-1
CAS NO. Mixture

DATE: OCT 05, 1992

EMERGENCY TELEPHONE: (201)-835-3100 (U.S.A.)

PRODUCT IDENTIFICATION

TRADE NAME: ARSENAL® NS Herbicide

SYNONYMS: Imazapyr, isopropylamine salt. 2-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinic acid, salt with isopropylamine (1:1) 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyri-dinecarboxylic acid, salt with 2-propanamine (1:1); AC252,925; CL252,925

CHEMICAL FAMILY: Imidazolinone

MOLECULAR FORMULA: $C_{13}H_{15}N_3O_3.C_3H_9N$

MOLECULAR WEIGHT: 320.400

USAGE: Herbicide

WARNING STATEMENTS

CAUTION! Keep out of reach of children.
Avoid contact with eyes, skin, or clothing.
Avoid breathing spray mist.

INGREDIENTS

COMPONENT	CAS. NO.	%	PEL/TLV
Inerts		71.90	None Established
Isopropylamine Salt of Imazapyr	081510-83-0	28.10	None Established

REFERENCE: Inerts None
Isopropylamine Salt of Imazapyr None

PHYSICAL PROPERTIES

APPEARANCE AND ODOR: Clear blue liquid; slight ammonium odor.

BOILING POINT: Not available

MELTING POINT: Not applicable

VAPOR PRESSURE: Not available

SPECIFIC GRAVITY: 1.04 - 1.07

VAPOR DENSITY: Not available

% VOLATILITY (BY VOL.): 71

OCTANOL / H_2O PARTITION COEF.: 1.3 for the active ingredient at 22°C

PH: 6.6 - 7.2

(cont from pg. 1)	SATURATION IN AIR (BY VOL.):	Not available
	EVAPORATION RATE:	Not available
	SOLUBILITY IN WATER:	Soluble
FIRE AND EXPLOSION HAZARD INFORMATION	FLASH POINT:	> 98.9°C (210°F) - SETA Closed Cup
	FLAMMABLE LIMITS (% BY VOL.):	Not applicable
	AUTOIGNITION TEMP:	> 93°C (200°F)
	DECOMPOSITION TEMP:	Not available

FIRE EXTINGUISHING MEDIA:
Use water, alcohol foam, dry chemical or carbon dioxide to extinguish fires.

FIRE CONTROL TACTICS:
Wear self-contained, positive pressure breathing apparatus and full fire fighting protective clothing.

Keep unnecessary people away. Use as little water as possible. Dike area of fire to prevent pesticide run-off. Use spray or fog - solid stream may cause spreading.

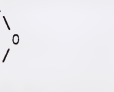
Do not decontaminate personnel or equipment, or handle broken packages or containers without protective equipment as specified in the Exposure Control Section. Decontaminate emergency personnel with soap and water before leaving the fire area.

Avoid breathing dusts, vapors and fumes from burning materials. Control run-off water - if water enters a drainage system, advise the authorities downstream.

NFPA HAZARD RATING

(As Recommended by American Cyanamid Co.)

0 Least
1 Slight
2 Moderate
3 High
4 Severe



REACTIVITY DATA	STABILITY:	Stable
	POLYMERIZATION:	Will not occur
	INCOMPATIBLE MATERIALS:	Strong oxidizing and reducing agents. Corrosive to mild steel and brass.
	HAZARDOUS DECOMPOSITION PRODUCTS:	Combustion may produce oxides of carbon and nitrogen.

HEALTH HAZARD INFORMATION

TOXICITY DATA AND EFFECTS OF OVEREXPOSURE:

BROADLEAF WEEDS

COMMON NAME	SPECIES	GROWTH HABIT[2]
Apply 2-3 pints per acre[1]		
Plantain	*(Plantago spp.)*	P
Puncturevine	*(Tribulus terrestris)*	A
Russian thistle	*(Salsola kali)*	A
Smartweed	*(Polygonum spp.)*	A,P
Sorrell	*(Rumex spp.)*	P
Sunflower	*(Helianthus spp.)*	A
Sweet clover	*(Melilotus spp.)*	A,B
Tansymustard	*(Descurainia pinnata)*	A
Western ragweed	*(Ambrosia psilostachya)*	P
Wild carrot	*(Daucus carota)*	B
Wild lettuce	*(Lactuca spp.)*	A,B
Wild parsnip	*(Pastinaca sativa)*	B
Wild turnip	*(Brassica campestris)*	B
Woollyleaf bursage	*(Ambrosia grayi)*	P
Yellow woodsorrel	*(Oxalis stricta)*	P
Apply 3-4 pints per acre[1]		
Broom snakeweed [3]	*(Gutierrezia sarothrae)*	P
Bull thistle	*(Cirsium vulgare)*	B
Cocklebur	*(Xanthium strumarium)*	A
Desert camelthorn	*(Alhagi camelorum)*	P
Diffuse knapweed	*(Centaurea diffusa)*	A
Dock	*(Rumex spp.)*	P
Goldenrod	*(Solidago spp.)*	P
Pokeweed	*(Phytolacca americana)*	A
Purple loosestrife [3]	*(Lythrum salicana)*	P
Purslane	*(Portulaca spp.)*	A
Rush skeletonweed [3]	*(Chondrilla juncea)*	B
Saltbush	*(Atriplex spp.)*	A
Stinging nettle [3]	*(Urtica dioica)*	P
Yellow starthistle	*(Centaurea solstitialis)*	A
Apply 4-6 pints per acre[1]		
Arrowwood	*(Pluchea sericea)*	A
Canada thistle	*(Cirsium arvense)*	P
Giant ragweed	*(Ambrosia trifida)*	A
Japanese bamboo	*(Polygonum cuspidatum)*	P
Little mallow	*(Malva parviflora)*	B
Milkweed	*(Asclepias spp.)*	P
Primrose	*(Oenothera kunthiana)*	P
Russian knapweed	*(Centaurea repens)*	P
Silverleaf nightshade	*(Solanum elaeagnifolium)*	P
Sowthistle	*(Sonchus spp.)*	A
Texas thistle	*(Cirsium texanum)*	P

VINES AND BRAMBLES

COMMON NAME	SPECIES	GROWTH HABIT[2]
Apply 1 pint per acre		
Field bindweed	*(Convolvulus arvensis)*	P
Hedge bindweed	*(Calystegia sepium)*	A
Apply 2-3 pints per acre[1]		
Wild buckwheat	*(Polygonum convolvulus)*	P
Apply 3-4 pints per acre[1]		
Greenbriar	*(Smilax spp.)*	P
Honeysuckle	*(Lonicera spp.)*	P
Morningglory	*(Ipomoea spp.)*	A,P
Poison ivy	*(Rhus radicans)*	P
Redvine	*(Brunnichia cirrhosa)*	P
Wild rose Including: Multiflora rose Macartney rose	*(Rosa spp.)* *(Rosa multiflora)* *(Rosa bractreata)*	P
Apply 4-6 pints per acre[1]		
Blackberry [4]	*(Rubus spp.)*	P
Dewberry [4]	*(Rubus spp.)*	P
Kudzu [5]	*(Pueraria lobata)*	P
Trumpetcreeper	*(Campsis radicans)*	P
Virginia creeper	*(Parthenocissus quinquefolia)*	P
Wild grape	*(Vitis spp.)*	P

BRUSH SPECIES

COMMON NAME	SPECIES	GROWTH HABIT[2]
Apply 4-6 pints per acre[1]		
American beech	*(Fagus grandifolia)*	P
Ash	*(Fraxinus spp.)*	P
Bald cypress	*(Taxodium distichum)*	P
Bigleaf maple	*(Acer macrophylum)*	P
Blackgum	*(Nyssa sylvatica)*	P
Boxelder	*(Acer negundo)*	P
Cherry	*(Prunus spp.)*	P
Chinaberry	*(Melia azedarach)*	P
Chinese tallow-tree	*(Sapium sebiferum)*	P
Dogwood	*(Cornus spp.)*	P
Hawthorn	*(Crataegus spp.)*	P
Hickory	*(Carya spp.)*	P
Maple	*(Acer spp.)*	P
Mulberry	*(Morus spp.)*	P
Oak	*(Quercus spp.)*	P
Persimmon	*(Diospyros virginiana)*	P
Poplar	*(Populus spp.)*	P
Privet	*(Ligustrum vulgare)*	P

BRUSH SPECIES

COMMON NAME	SPECIES	GROWTH HABIT[2]
	Apply 4-6 pints per acre[1]	
Russian olive	*(Elaeagnus angustifolia)*	P
Red alder	*(Alnus rubra)*	P
Red maple	*(Acer rubrum)*	P
Rubber rabbitbrush	*(Chrysothamnus nauseosus)*	P
Saltcedar	*(Tamanx ramosissima)*	P
Sassafras	*(Sassafras albidum)*	P
Sourwood	*(Oxydendrum arboreum)*	P
Sumac	*(Rhus spp.)*	P
Sweetgum	*(Liquidambar styraciflua)*	P
Willow	*(Salix spp.)*	P
Yellow poplar	*(Linodendron tulipifera)*	P

[1]The higher rates should be used where heavy or well established infestations occur
[2]Growth Habit - A = Annual B = Biennial P = Perennial
[3]For best results early postemergence applications are required
[4]The degree of control is species dependent. Some *Rubus* species may not be completely controlled
[5]Use a minimum of 75 GPA - Control of established stands may require repeat applications.

American Cyanamid Company
Agricultural Division
Vegetation and Pest Control
Wayne, NJ 07470

IMPORTANT: To minimize drift, select proper nozzles; to avoid spraying a fine mist, DO NOT exceed spray pressure of 50 psi, and DO NOT spray under windy or gusty conditions.

Clean application equipment after using this product by thoroughly flushing with water

LOW-VOLUME HAND-HELD SPRAY EQUIPMENT

Thoroughly mix a 1/2 to 1 percent solution of ARSENAL in water. To determine the proper percent solution of ARSENAL to use, see the "WEEDS CONTROLLED" section of this label and the "PERCENT SOLUTION RATE GUIDE" below. The table calculations below are based on an approximate delivery volume of 50 to 75 gallons per acre.

PERCENT SOLUTION RATE GUIDE

ARSENAL RATE PER ACRE	PERCENT SOLUTION TO MIX
2-3 pints	1/2%
3-4 pints	3/4%
4-6 pints	1%

For best results, uniformly cover the foliage of the vegetation to be controlled with the spray solution.

DO NOT overapply and cause runoff from the treated foliage.

To mix the spray solution, add the volume of ARSENAL indicated in the table below to the desired amount of water.

SPRAY SOLUTION MIXING GUIDE

SOLUTION VOLUME	AMOUNT OF ARSENAL TO USE (fluid volume)		
	1/2%	3/4%	1%
1 gallon	2/3 oz.	1 oz.	1-1/3 oz.
5 gallons	3-1/3 oz.	5 oz.	6-1/2 oz.
10 gallons	6-2/3 oz.	10 oz.	13 oz.
25 gallons	1 pint	1-1/2 pints	2 pints

2 tablespoons = 1 fluid ounce

IMPORTANT: DO NOT exceed recommended dosage rate per acre. DO NOT side-trim desirable vegetation with this product. Clean application equipment after using this product by thoroughly flushing with water.

HIGH-VOLUME SPRAY EQUIPMENT

ARSENAL may be applied using high-volume spray equipment. For best results, apply ARSENAL using the least amount of water practical to obtain uniform coverage of the vegetation foliage. Using excessive spray volumes when cause runoff from the plant foliage may result in reduced performance.

When using spray volumes greater than 60 gallons per acre, additional nonionic surfactant such as Ortho* X-77 must then be added at the rate of 1 quart per 100 gallons of spray solution to provide optimum wetting and/or contact activity. A foam reducing agent may be added at the recommended label rate, if needed. If desired, a spray pattern indicator may be added at the recommended label rate.

To mix the spray solution, determine the proper ARSENAL pints per acre rate from the "WEEDS CONTROLLED" section of this label and mix according to the table below.

SPRAY SOLUTION MIXING GUIDE

SPRAY VOLUME (GAL/ACRE)	PINTS ARSENAL TO MIX PER 100 GALLONS WATER			
	3 PTS/ACRE	4 PTS/ACRE	5 PTS/ACRE	6 PTS/ACRE
50	6	8	10	12
100	3	4	5	6
150	2	2-3/4	3-1/4	4

IMPORTANT: DO NOT exceed recommended dosage rate per acre. DO NOT side-trim desirable vegetation with this product. Clean application equipment after using this product by thoroughly flushing with water.

*Registered Trademark of Chevron Chemical Company

FOR CONTROL OF UNDESIRABLE WEEDS IN UNIMPROVED BERMUDAGRASS AND BAHIAGRASS

For use on unimproved bermudagrass and bahiagrass turf such as roadsides, utility rights-of-way and other noncropland industrial sites. The application of ARSENAL on established common and coastal bermudagrass and bahiagrass provides control of labeled broadleaf and grass weeds. Competition from these weeds is eliminated, releasing the bermudagrass and bahiagrass. Treatment of bermudagrass with ARSENAL results in a compacted growth habit and seedhead inhibition.

Uniformly apply with properly calibrated ground equipment using at least 10 gallons of water per acre with a spray pressure 20 to 50 psi.

DOSAGE RATES AND TIMING

EARLY SPRING - DORMANT: Apply ARSENAL at 6 to 12 fluid oz. per acre for bermudagrass, and 4 to 8 fluid oz. per acre for bahiagrass when the grass is still dormant and has not initiated new growth.

SPRING - UP TO 25% GREEN-UP: Apply ARSENAL at 6 to 8 fluid oz. per acre for bermudagrass and 4 to 8 fluid oz. per acre for bahiagrass after the grass has initiated green-up but has not exceeded 25% green-up.

WEEDS CONTROLLED

Bedstraw *(Galium spp.)*
Bishopweed *(Ptilimnium capillaceum)*
Buttercups *(Ranunculus spp.)*
Carolina geranium *(Geranium carolinianum)*
Fescue *(Festuca spp.)*
Foxtail *(Setaria spp.)*
Little barley *(Hordeum pusillum)*
Seedling Johnsongrass *(Sorghum halepense)*
Wild carrot *(Daucus carota)*
White clover *(Trifolium repens)*
Yellow woodsorrel *(Oxalis stricta)*

1. DO NOT APPLY to grass during its first growing season.
2. DO NOT APPLY to grass that is under stress from drought, disease, insects, or other causes.
3. Temporary yellowing of grass may occur when treatment is made after growth commences.
4. DO NOT add a surfactant.

FOR CONTROL OF UNDESIRABLE WEEDS UNDER PAVED SURFACES

ARSENAL herbicide can be used under asphalt, pond liners and other paved areas, ONLY in industrial sites or where the pavement has a suitable barrier along the perimeter that prevents encroachment of roots of desirable plants.

ARSENAL should be used only where the area to be treated has been prepared according to good construction practices. If rhizomes, stolons, tubers or other vegetative plant parts are present in the site, they should be removed by scalping with a grader blade to a depth sufficient to insure their complete removal.

APPLICATION DIRECTIONS

Applications should be made to the soil surface only when final grade is established. Do not move soil following ARSENAL application.

Uniformly apply ARSENAL to the area to be surfaced, including the shoulder areas at a rate of 6 pints per acre.

Apply ARSENAL in sufficient water (at least 100 gal. per acre) to insure thorough wetting of the soil surface. Add the recommended amount of ARSENAL to clean water in the spray tank during the filling operation. Agitate before spraying.

For Herbicide Activation:

On Moist Subsoils: Apply ARSENAL after final grading and immediately before laying asphalt or liner surface. Apply uniformly, using at least 100 gallons of water per acre.

If Moisture Is Not Present: Incorporation of ARSENAL is needed for herbicide activation. ARSENAL can be incorporated into the soil to a depth of 4 to 6 inches using a rototiller or disc. Rainfall or irrigation of 1 inch will also provide uniform incorporation. Do not allow treated soil to wash or move into untreated areas.

IMPORTANT

Paving should follow ARSENAL applications as soon as possible. DO NOT apply where the chemical may contact the roots of desirable trees or other plants.

The product is not recommended for use under pavement on residential properties such as driveways or parking lots, nor is it recommended for use in recreational areas such as under bike or jogging paths, golf cart paths, or tennis courts, or where landscape plantings could be anticipated.

Injury or death of desirable plants may result if this product is applied where roots are present or where they may extend into the treated area. Roots of trees and shrubs may extend a considerable distance beyond the branch extremities or drip line.

WEEDS CONTROLLED

ARSENAL herbicide will provide postemergence control with residual control of the following target vegetation species at the rates listed. Residual control refers to control of newly germinating seedlings in both annuals and perennials. In general, annual weeds may be controlled by postemergence or preemergence applications of ARSENAL, whereas, for established biennials and perennials postemergence applications of ARSENAL are recommended. ARSENAL herbicide should be used only in accordance with the recommendations on this label and the leaflet label.

GRASSES

COMMON NAME	SPECIES	GROWTH HABIT[2]
Apply 2-3 pints per acre[1]		
Annual bluegrass	*(Poa annua)*	A
Broadleaf signalgrass	*(Brachiaria platyphylla)*	A
Canada bluegrass	*(Poa compressa)*	P
Downy brome	*(Bromus tectorum)*	A
Fescue	*(Festuca spp.)*	A/P
Foxtail	*(Setaria spp.)*	A
Italian ryegrass	*(Lolium multiflorum)*	A
Johnsongrass	*(Sorghum halepense)*	P
Kentucky bluegrass	*(Poa pratensis)*	P
Lovegrass	*(Eragrostis spp.)*	A/P
Orchardgrass	*(Dactylis glomerata)*	P
Paragrass	*(Brachiaria mutica)*	P
Quackgrass	*(Agropyron repens)*	P
Sandbur	*(Cenchrus spp.)*	A
Sand dropseed	*(Sporobolus cryptandrus)*	P
Smooth brome	*(Bromus inermis)*	P
Vaseygrass	*(Paspalum urvillei)*	P
Wild oats	*(Avena fatua)*	A
Witchgrass	*(Panicum capillare)*	A
Apply 3-4 pints per acre[1]		
Beardgrass	*(Andropogon spp.)*	P
Cheat	*(Bromus secalinus)*	A
Crabgrass	*(Digitaria spp.)*	A
Fall panicum	*(Panicum dichotomiflorum)*	A
Goosegrass	*(Eleusine indica)*	A
Prairie threeawn	*(Aristida oligantha)*	P
Reed canarygrass	*(Phalaris arundinacea)*	P

GRASSES

COMMON NAME	SPECIES	GROWTH HABIT[2]
Apply 3-4 pints per acre[1]		
Torpedograss	*(Panicum repens)*	P
Wild barley	*(Hordeum spp.)*	A
Apply 4-6 pints per acre[1]		
Bahiagrass	*(Paspalum notatum)*	P
Bermudagrass	*(Cynodon dactylon)*	P
Big bluestem	*(Andropogon gerardi)*	P
Cattail	*(Typha spp.)*	P
Cogongrass	*(Imperata cylindnca)*	P
Dallisgrass	*(Paspalum dilatatum)*	P
Feathertop	*(Pennisetum villosum)*	P
Guineagrass	*(Panicum maximum)*	P
Phragmites	*(Phragmites australis)*	P
Prairie cordgrass	*(Spartina pectinata)*	P
Saltgrass	*(Distichlis stncta)*	P
Timothy	*(Phleum pratense)*	P
Wirestem muhly	*(Muhlenbergia frondosa)*	P

BROADLEAF WEEDS

COMMON NAME	SPECIES	GROWTH HABIT[2]
Apply 2-3 pints per acre[1]		
Burdock	*(Arctium spp.)*	B
Camphorweed	*(Heterotheca subaxillans)*	P
Carpetweed	*(Mollugo verticillata)*	A
Carolina geranium	*(Geranium carolinianum)*	A
Clover	*(Trifolium spp.)*	A,P
Common chickweed	*(Stellana media)*	A
Common ragweed	*(Ambrosia artemisiifolia)*	A
Dandelion	*(Taraxacum officinale)*	P
Dogfennel	*(Eupatorium capillifolium)*	A
Filaree	*(Erodium spp.)*	A
Fleabane	*(Engeron spp.)*	A
Hoary vervain	*(Verbena stncta)*	P
Horseweed	*(Conyza canadensis)*	A
Indian mustard	*(Brassica juncea)*	A
Lambsquarters	*(Chenopodium album)*	A
Lespedeza	*(Lespedeza spp.)*	P
Miners lettuce	*(Montia perfoliata)*	A
Mullein	*(Verbascum spp.)*	B
Nettleleaf goosefoot	*(Chenopodium murale)*	A
Oxeye daisy	*(Chrysanthemum leucanthemum)*	P
Pepperweed	*(Lepidium spp.)*	A
Pigweed	*(Amaranthus spp.)*	A

SPECIMEN

ACTIVE INGREDIENT:

Isopropylamine salt of Imazapyr (2-[4,5-dihydro-4-methyl-4-(1- methylethyl)-5-oxo-1*H*-imidazol-2-yl]-3-pyridinecarboxylic acid)*	27.6%
INERT INGREDIENTS	72.4%
TOTAL	100.0%

*Equivalent to 22.6% 2-[4.5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-3-pyridinecarboxylic acid or 2 pounds acid per gallon.

EPA Reg. No. 241-273

KEEP OUT OF REACH OF CHILDREN

CAUTION!/¡PRECAUCION!

PRECAUCION AL USUARIO: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.

In case of emergency endangering life or property involving this product, call collect, day or night, Area Code 201-835-3100.

See inside for Additional Precautionary Statements
See inside for Directions For Use.

CYANAMID
American Cyanamid Company
Agricultural Division
Vegetation and Pest Control
Wayne, NJ 07470

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS

CAUTION!

Avoid contact with skin, eyes or clothing. Avoid breathing spray mist. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

FIRST AID

IF ON SKIN: Wash with plenty of soap and water.

IF IN EYES: Flush with plenty of water. Get medical attention if irritation persists

PHYSICAL AND CHEMICAL HAZARDS

Spray solutions of ARSENAL should be mixed, stored and applied only in stainless steel, fiberglass, plastic and plastic-lined steel containers.

DO NOT mix, store or apply ARSENAL or spray solutions of ARSENAL in unlined steel (except stainless steel) containers or spray tanks.

ENVIRONMENTAL HAZARDS

DO NOT apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. DO NOT contaminate water when disposing of equipment washwaters.

IMPORTANT

DO NOT use on food or feed crops. **DO NOT** treat irrigation ditches or water used for crop irrigation or for domestic purposes. Keep from contact with fertilizers, insecticides, fungicides and seeds. **DO NOT** apply or drain or flush equipment on or near desirable trees or other plants, or on areas where their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots. **DO NOT** use on lawns, walks, driveways, tennis courts, or similar areas. **DO NOT** side trim desirable vegetation with this product. Prevent drift of spray to desirable plants. **DO NOT USE** in California.

Clean application equipment after using this product by thoroughly flushing with water.

GENERAL INFORMATION

ARSENAL herbicide is an aqueous solution containing surfactant to be mixed in water and applied as a spray for control of most annual and perennial grasses and broadleaf weeds on noncropland areas.

ARSENAL may be applied either preemergence or postemergence to the weeds; however, postemergence application is the method of choice in most situations, particularly for control of perennials. For maximum activity, weeds should be growing vigorously at the time of postemergence applications. The preemergence activity of ARSENAL will provide residual control of new germination of most weed species following a postemergence application.

ARSENAL is readily absorbed through foliage and roots and is translocated rapidly throughout the plant, with accumulation in the menstematic regions. Treated plants stop growing soon after spray application. Chlorosis appears first in the newest leaves, and necrosis spreads from this point. In perennials, the herbicide is translocated into, and kills, underground storage organs, thus preventing regrowth. Chlorosis and tissue necrosis may not be apparent in some plant species until two weeks after application. Complete kill of plants may not occur for several weeks.

DISCLAIMER

The label instructions for the use of this product reflect the opinion of experts based on field use and tests. The directions are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks inherently associated with use of this product. Ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the use or application of the product contrary to label instructions, all of which are beyond the control of American Cyanamid Company. All such risks shall be assumed by the user.

American Cyanamid Company warrants only that the material contained herein conforms to the chemical description on the label and is reasonably fit for the use therein described,when used in accordance with the directions for use, subject to the risks referred to above.

Any damages arising from a breach of this warranty shall be limited to direct damages and shall not include consequential commercial damages such as loss of profits or values or any other special or indirect damages.

American Cyanamid Company makes no other express or implied warranty, including other express or implied warranty of FITNESS or of MERCHANTABILITY.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

ARSENAL herbicide should be used only in accordance with recommendations on the leaflet label attached to the container. Keep containers closed to avoid spills and contamination.

A postemergence use of ARSENAL is recommended for control of most annual and perennial grasses and broadleaf weeds on noncropland areas such as railroad, utility, pipeline and highway rights-of-way, utility plant sites, petroleum tank farms, pumping installations, fence rows, storage areas, non-irrigation ditchbanks, and other similar areas. ARSENAL is recommended for the establishment and maintenance of wildlife openings. ARSENAL may also be used for the release of unimproved bermudagrass (see specific labeling).

STORAGE AND DISPOSAL

PROHIBITIONS: DO NOT store below 10°F. DO NOT contaminate water, food or feed by storage or disposal.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in an approved sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

APPLICATION EQUIPMENT AND TECHNIQUES

ARSENAL herbicide may be applied with the following application equipment:

Aerial: fixed wing and helicopter.

Boom: conventional boom mounted, manifold mounted, and off-center nozzles.

Low-volume hand-held spray equipment: backpack, knapsack and other pump-up type pressure sprayers and backpack mist blowers used to direct application to weed foliage.

High-volume spray equipment: high pressure handguns and vehicle mounted high-volume directed spray equipment.

AERIAL EQUIPMENT

Uniformly apply the recommended amount of ARSENAL with properly calibrated aerial equipment in 5 to 30 gallons of water per acre. All precautions should be taken to minimize or eliminate spray drift. Aerial equipment designed to minimize spray drift, such as a helicopter equipped with a MICROFOIL boom, THRU- VALVE boom or raindrop nozzles, must be used. Applications should not be made under gusty conditions or when wind velocity exceeds 5 mph. Except when applying with a MICROFOIL boom, a drift control agent may be added at the recommended label rate. A foam reducing agent may be added at the recommended label rate, if needed.

IMPORTANT: DO NOT make applications by fixed wing aircraft unless appropriate buffer zones can be maintained to insure that drift does not occur off the target area. Thoroughly clean application equipment, including landing gear, immediately after use. Prolonged exposure of this product to uncoated steel (except stainless steel) surfaces may result in corrosion and failure of the exposed part.

BOOM EQUIPMENT

Mix the recommended amount of ARSENAL in 10 to 60 gallons of water per acre in the spray tank with the agitator running. A foam reducing agent may be added at the recommended label rate, if needed. If desired, a spray pattern indicator may be added at the recommended label rate. Check for even distribution in spray pattern.

APPENDIX E. CHEMICAL WEED CONTROL GUIDELINES FOR MAJOR WEEDS ON REGION 5 FWP SITES (Montana Weed Control Guides, MSU Cooperative Extension Service, MSU, Bozeman, MT 1992)

APPENDIX E. CHEMICAL WEED CONTROL GUIDELINES FOR MAJOR WEEDS ON REGION 5 FWP SITES (Montana Weed Control Guides, MSU Cooperative Extension Service, MSU, Bozeman, MT 1992)

APPENDIX F.

SITE SPECIFIC WEED MANAGEMENT INVENTORY AND PRESCRIPTION

SITE: _____ DATE: _____

INVESTIGATOR: _____ AVERAGE SLOPE OR RANGE: _____

ELEVATION: _____ ASPECT(S): _____

GENERAL VEGETATION: (ATTACH SITE SKETCH IF NEEDED)

FOREST % RANGE % RIPARIAN % OTHER %

VEGETATION HABITAT TYPES:

PAST WEED CONTROL:

GENERAL SURFACE AND GROUNDWATER CONDITIONS: (ATTACH SKETCH IF NEEDED)

GENERAL SOIL CONDITIONS:

WEED SPECIES: (COVERAGE CLASSES ARE R=RARE, F=FEW, C=COMMON, A=ABUNDANT)

WEED SPECIES	COVERAGE CLASS	ACRES	OTHER INFORMATION

SITE SPECIFIC WEED MANAGEMENT INVENTORY AND PRESCRIPTION

SITE: _____ DATE: _____

INVESTIGATOR: _____ AVERAGE SLOPE OR RANGE: _____

ELEVATION: _____ ASPECT(S): _____

GENERAL VEGETATION: (ATTACH SITE SKETCH IF NEEDED)

FOREST____% RANGE____% RIPARIAN____% OTHER_____%

VEGETATION HABITAT TYPES: _____

PAST WEED CONTROL: _____

GENERAL SURFACE AND GROUNDWATER CONDITIONS: (ATTACH SKETCH IF NEEDED)

THREATENED, ENDANGERED AND OTHER SPECIES OF SPECIAL CONCERN:

SPECIES	OTHER INFOMATION (LOCATION)

GENERAL SOIL CONDITIONS:

NOTES: _____

MANAGEMENT ZONE 1 - WATER QUALITY ZONE

GENERAL INFORMATION _____

_____

_____

WEEDS (COVER CLASSES: T=TRACE, 1=TRACE-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%)

WEED SPECIES	COVER*	ACRES	OTHER INFORMATION

MAJOR VEGETATION (ATTACH SITE MAP IF NEEDED):

PLANT SPECIES	CVR *	PLANT SPECIES	CVR *	PLANT SPECIES	CVR *

WEED CONTROL PRESCRIPTION (ATTACH MAP OF MZs)

_____

_____

_____

_____

_____

_____

GROUNDWATER DEPTH: ____ FT SOURCE OF INFO (WELL LOG, GUESS): _____

SURFACE WATER: _____

_____

_____

MANAGEMENT ZONE 2 - SENSITIVE SPECIES ZONE

GENERAL INFORMATION _____

_____

_____

WEEDS (COVER CLASSES: T=TRACE, 1=TRACE-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%)

WEED SPECIES	COVER*	ACRES	OTHER INFORMATION

MAJOR VEGETATION (ATTACH SITE MAP IF NEEDED):

PLANT SPECIES	CVR *	PLANT SPECIES	CVR *	PLANT SPECIES	CVR *

WEED CONTROL PRESCRIPTION (ATTACH MAP OF MZs)

_____

_____

_____

_____

_____

_____

GROUNDWATER DEPTH:____FT SOURCE OF INFO (WELL LOG, GUESS):_____

SURFACE WATER: _____

_____

_____

MANAGEMENT ZONE 3 - HIGH HUMAN USE ZONE

GENERAL INFORMATION _____

_____

_____

WEEDS (COVER CLASSES: T=TRACE, 1=TRACE-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%)

WEED SPECIES	COVER*	ACRES	OTHER INFORMATION

MAJOR VEGETATION (ATTACH SITE MAP IF NEEDED):

PLANT SPECIES	CVR *	PLANT SPECIES	CVR *	PLANT SPECIES	CVR *

WEED CONTROL PRESCRIPTION (ATTACH MAP OF MZs)

_____

_____

_____

_____

_____

_____

GROUNDWATER DEPTH:____FT SOURCE OF INFO (WELL LOG, GUESS):_____

SURFACE WATER: _____

_____

_____

MANAGEMENT ZONE 4 - GENERAL WEED MANAGEMENT ZONE

GENERAL INFORMATION _____

_____

_____

WEEDS (COVER CLASSES: T=TRACE, 1=TRACE-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-100%)

WEED SPECIES	COVER*	ACRES	OTHER INFORMATION

MAJOR VEGETATION (ATTACH SITE MAP IF NEEDED):

PLANT SPECIES	CVR *	PLANT SPECIES	CVR *	PLANT SPECIES	CVR *

WEED CONTROL PRESCRIPTION (ATTACH MAP OF MZs)

_____

_____

_____

_____

_____

_____

GROUNDWATER DEPTH:____FT SOURCE OF INFO (WELL LOG, GUESS):_____

SURFACE WATER: _____

_____

_____

SITE MAPS (MANAGEMENT ZONES, WEED DISTRIBUTION, TES DISTRIBUTION, OWNERSHIP, TOPOGRAPHY)

SITE: _____ INFORMATION: _____

APPENDIX G. WEED CONTROL EFFECTIVENESS MONITORING

Monitoring is essential to document the effectiveness of weed control efforts. Data can be used to refine program specifications choose alternatives. Monitoring may range from photographs at reference points and notes on general observations of weed presence and density to statistically valid documentation of plant community changes and larger ecosystem effects.

EXAMPLE MEDIUM-INTENSITY PLOT MONITORING METHODS

1 Select monitoring sites within treatment zones which can be easily relocated.

2 Choose a starting point which is easy to locate.

3 Layout a transect and locate microplots at regular intervals.

4 Use a plot frame of .5 square meters or similar standard size and estimate the canopy coverage of each major weed as well as "other forbs", "grass" and "bare soil/rock". Other categories may be needed on some sites.

5 Note the presence of non-target species.

6 Photograph along transect from starting point.

7 Compute means and standard deviations then compare coverage results before and after treatments. Compare species lists to evaluate the impacts on non-target species.

EXAMPLE WEED CONTROL MONITORING FORM

SITE: _____ **DATE:** _____

PLOT NO: _____ **NAME:** _____

STARTING POINT: _____

_____

DIRECTION: _____

% CANOPY COVERAGE - RECORD 20 READINGS FOR EACH MAJOR WEEDS

MAJOR WEEDS											MEAN
SPOTTED KNAPWEED											
LEAFY SPURGE											
CANADA THISTLE											
OTHER WEEDS											
GRASSES											
OTHER FORBS											
BARE SOIL/ROCK											

OTHER WEEDS

NON-TARGET PLANTS:

NOTES: _____

_____

_____

_____

APPENDIX H. PESTICIDE SPILL RESPONSE PLAN

This plan includes reporting and response procedures to follow in the event of a pesticide spill. This plan applies to all FWP personnel and contractors when an accident occurs involving the transport, application, use or handling of a pesticide. Included are emergency response telephone numbers, field personnel duties and spill documentation procedures.

IN THE EVENT OF A SPILL - IMMEDIATELY

1. **Administer First Aid to Injured or Contaminated Persons**
2. **Identify Type of Pesticide Released**
3. **Notify the Appropriate Authorities**
4. **Quarantine the Area**
5. **Contain the Spill if Possible**
6. **Complete Pesticide Emergency Response Record**
7. **Develop a Clean-Up Plan Where Appropriate**

The first priority in pesticide emergencies is protection of personnel involved in the accident, spill containment and clean-up. The next priority is minimizing environmental contamination. Injured parties should be moved from the contaminated area immediately and contaminated clothing removed. The chemical should be identified and first aid administered based on label information and material safety data sheets. Initial first aid for skin contact usually includes washing with water and detergent. Initial first aid for eye contact usually includes rinsing with eye-safe solutions or water. Transport injured parties to medical facilities as soon as possible and send information on the chemical, especially the name, label, and material safety data sheet.

Restrict access to the site as needed using physical barriers and/or signs. Avoid contact with spilled material until it is positively identified. Only personnel with appropriate protective clothing should enter the spill area.

All FWP personnel and contractors who transport, apply, handle and use pesticides must carry a spill response kit including those items on the attached list. A pesticide emergency report form will be completed for all spill, accidents or other emergencies or material releases involving pesticides.

The improper use or accidental release of a pesticide may pose a serious health or environmental hazard. Accidental spills and releases must be responded to quickly and procedures exercised efficiently to ensure the protection of human health and the environment. Additional information on the handling and use of pesticides can be found in the Montana Pesticide Act (80.8.101 MCA) and its Administrative Rules (ARM 4.10.101).

1. ADMINISTER AID TO INJURED PERSONS

Of greatest importance is the immediate threat to human health and the aid of someone injured from a pesticide spill. Any injured parties should be removed from the contaminated area immediately. Contaminated clothing should be removed. If the released chemical is known, the appropriate procedures for administering first aid and decontamination will be described on label information and material safety data sheets. For most pesticides, washing with water and detergent is the best method. Injured parties, should be transported to medical facilities as soon as possible, with the name of the released material, label, and material safety data sheet accompanying the injured person.

[include first aid instructions from basic pesticide training manual]

2. IDENTIFY SPILLED MATERIAL

To administer the most appropriate emergency response, the spilled pesticide must be accurately identified. Pesticide label information and Material Safety Data Sheets (MSDS) should accompany all FWP personnel and their contractors if a pesticide is handled, transported, applied or used. The MSDS sheets will provide information concerning appropriate response procedures for administering emergency aid to affected parties and appropriate protective clothing for containing a spill. The transporter and applicator of the pesticide must carry records describing mixtures of all pesticides applied.

3. NOTIFY AUTHORITIES

Pesticides can pose serious threats to human health and the environment and should be handled with extreme care. In the event of a release, follow these specific notification procedures. The following authorities may be contacted as indicated below:

FWP CONTACT: Maintenence Supervisor

Local Emergency Response		**911**
or		
County Sheriff, if in:	**Big Horn**	**665-1503**
	Carbon	**446-1234**
	Golden Valley	**568-2321**
	Musselshell	**323-1402**
	Stillwater	**322-5326**
	Sweet Grass	**932-5143**
	Wheatland	**632-5614**
	Yellowstone	**256-2929**

Montana Disaster & Emergency Services	**(406) 444-6911**
National Response Center	**(800) 424-8802**
Montana Department of Agriculture	**(406) 444-3144**

All pesticide spills and releases must be reported to the Montana Department of Agriculture within 48 hours. The written report must include the time of the incident, its location, pesticide name, type of formulation, method of application, and the FWP contact for the project. The report should also include all parties involved in the incident including the names and addresses of affected parties where the spill occurred. If the spilled pesticide is classified as either extremely toxic or highly toxic, the Department of Agriculture must be notified immediately.

OPTIONAL INFORMATION SOURCES
Below are other information sources for responding to and cleaning up pesticide spills.

CHEMTREC **(800) 424-9300**
The Chemical Manufacturer's Association maintains this 24 hour information hotline to fire and police crews responding to chemical accidents and spills and provide information about chemicals and their related health and environmental hazards.

Montana Poison Control Center **(800) 525-5042**
For specific information about response procedures and first aid for injured or contaminated persons.

Montana Environmental Management Division **(406) 444-2944**
For notifying appropriate environmental agencies concerning pesticide spills and accidents.

4. CONTAIN SPILL
Spill material must be contained as soon as possible. The spilled material must be identified first, prior to any containment begins. Technical labels and MSDS provide information on protective clothing requirements for clean-up personnel. Generally, these requirements will be similar to protective clothing requirements for applying the pesticide and will already be available at the site.

Put on all necessary protective clothing, including respirators, before approaching the spill. Approach the spill from an upwind direction. Avoid inhaling fumes, vapors, and dust from the spill. Smoking is not allowed in a spill area.

Potential Spill Containment Methods
Liquid Spills:

- create small collections pools for runoff
  create dikes to impound runoff
- cover spill material with approximately double its volume in absorbent material (hydrated lime, saw dust, kitty litter)
- in sandy soils, transfer absorbent onto an impermeable barrier (tarp)
- divert spilled material away from open waters
- monitor and plug leaks in containment structures

Dry Spills:

- cover with a plastic tarp and secure edges of the tarp
- spray fine mist to minimize dust
- shovel material into clearly marked plastic bags or drums and seal

Any person that attempts to contain a spilled pesticide should also follow these guidelines:

- minimize human contact with the spill, use mechanized equipment if possible
- all absorbent material, used in containment, must be treated as a hazardous waste
- avoid raising dust
- do not dilute material with water (except for misting dry substances)
- all contaminated soil must be removed and disposed as a hazardous waste
- do not consume any food until hands and face have been thoroughly washed and properly decontaminated

5. QUARANTINE AREA

In the event of a spill, the area should be secured to avoid unauthorized personnel entering the spill area. Only authorized persons with the appropriate protective clothing should be permitted into the spill area. Put up physical barriers such as emergency tape, flagging, and signs.

6. RECORD PESTICIDE SPILL

A pesticide spill or accident could potentially have effects that last longer than immediate health and environmental threats. It is important to document all events concerning the accident and spill. Important information should include the name and type of pesticide (include MSDS sheets), any injured or contaminated persons, amount spilled or released, where it was spilled, entry into a water body and other important information. Below is a reporting form to ensure all of the appropriate information has been documented.

PESTICIDE SPILL EMERGENCY RESPONSE FORM

Complete all appropriate items and add additional notes to document special conditions or unusual circumstances. Take photos when possible to supplement notes.

1. Immediately contact the appropriate response agencies.

2. Were there injuries related to the spill? ___yes ___no
   Were any individuals contaminated with pesticide? ___yes ___no
   Was aid provided to affected individuals? ___yes ___no
   Was transportation to a medical facility required? ___yes ___no

3. Was a vehicle accident involved? ___yes ___no

4. What materials/pesticides were involved? (include MSDS)
   _____

5. Estimate amount of pesticide or pesticide mixture spilled in gallons.
   Pesticide: _____ ____ gals – Mixture: _____ ____ gals
   Pesticide: _____ ____ gals – Mixture: _____ ____ gals
   Pesticide: _____ ____ gals – Mixture: _____ ____ gals

6. Location of Incident (name of site): _____
   ___1/4 ___1/4 ___Sec ___T ___R Highway/Road: _____
   Time of Incident: _____ Date: _____

   Provide a description of the site (water bodies, vegetation, landmarks)
   _____
   _____
   _____
   Distance to picnic/play campground area: _____
   nearest well: _____
   surface water: _____

7. Is there a danger of surface water contamination? ___yes ___no
   Has a pesticide already entered the water body? ___yes ___no
   Name of Stream/Lake _____

8. Is there a danger of ground water contamination? ___yes ___no
   Depth to groundwater: _____
   Elevation above nearest surface water: _____

9. General Soil Description (check one for surface and subsurface soil)

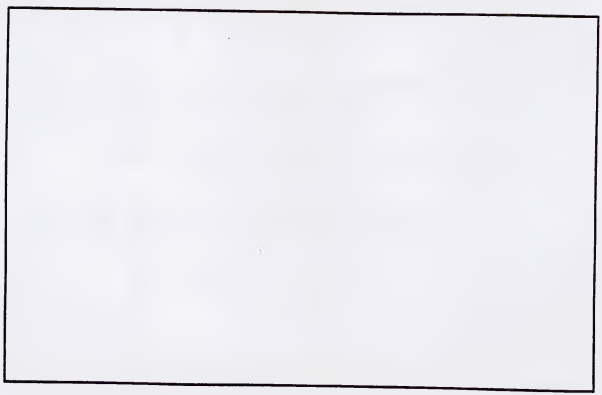
Surface ☐ Dark Colored, Organic, Rock Free
☐ Medium Textured
☐ Light Colored, Rocky

Subsoil ☐ Dark Colored, Organic, Rock Free
☐ Medium Textured
☐ Light Colored, Rocky

10. List Agencies Notified

FWP Authority _____ When _____
Local Authority _____ When _____
State Authority _____ When _____
Federal Authority _____ When _____
Other Authority _____ When _____

11. Site Sketch



12. Describe Incident: _____

_____

13. Public Contact/Comment During Incident: _____

_____

14. Name: _____ Date: _____

CHEMICAL EMERGENCY SPILL KIT

All FWP personnel and contractors applying or transporting pesticides must carry the following safety items in the vehicle.

- ☐ Portable Radio
- ☐ At least one pair of neoprene or plastic gloves for each crew member present
- ☐ At least one pair of rubber, neoprene, or plastic material boots
- ☐ At least one pair of unvented goggles for each crew member present
- ☐ At least one approved respirator for applied pesticide
- ☐ At least one pair of coveralls or disposable coveralls (Tyvek) for each crew member
- ☐ Twenty-five (25) pounds of absorbent material (kitty litter, floor dry)
- ☐ At least six (6) heavy duty plastic garbage sacks
- ☐ One (1) 24' x 36' plastic tarp
- ☐ Shovel
- ☐ Dustpan and shop brush
- ☐ One pint liquid detergent
- ☐ Portable eye wash kit
- ☐ One (1) five-pound ABC type fire extinguisher
- ☐ Material Safety Data Sheets and Technical Label Information for each pesticide handled and used
- ☐ Pesticide Spill Response Plan
- ☐ One (1) first aid kit
- ☐ Safety Tape/Flagging

APPENDIX I. THREATENED, ENDANGERED AND SENSITIVE SPECIES INFORMATION

GRINDELIA HOWELLII Steyermark
Howell's Gumweed Asteraceae (Sunflower Family)

MONTANA COUNTIES: Missoula, Powell

PHYSIOGRAPHIC DISTRIBUTION: Blackfoot and Clearwater river drainages.

U.S. FOREST SERVICE STATUS: Sensitive

NATIONAL FOREST(S): Lolo, Idaho Panhandle, Flathead, possibly the Kootenai

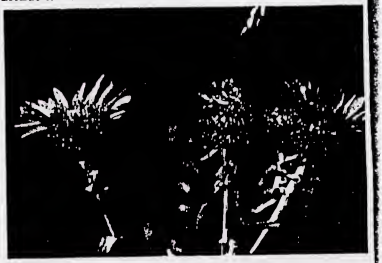
HABITAT: Various disturbed and natural habitats, including roadsides, grazed pastures, pine plantations, forest openings, river terraces, and native grasslands, 2500-4900 ft.

DESCRIPTION: Howell's gumweed is a short lived perennial with stems up to 90 cm (35 in) tall that are woody at the base, and clustered on a taproot. The basal leaves are lance shaped, broadest toward the tip, and up to 20 cm (8 in) long. The clasping stem leaves are reduced in size and entire-margined, or with shallow, ill defined teeth. The foliage is resinous and glandular. The stem is glandular haired, and usually also has some long, soft hairs. The flowering heads are borne in a terminal, open, leafy inflorescence. The numerous, narrow, involucre bracts are resinous and have green, recurved tips. The yellow rays (petal like outer flowers) are about 1 cm long. The heads are 0.25 mm across the top (not including the rays). The seads (achenes) are flat on the top, with a few stiff bristles that are easily removed.

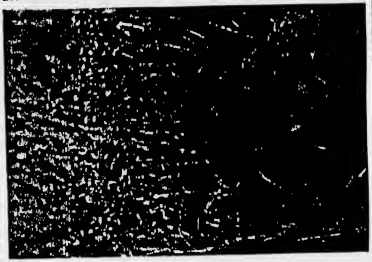
BLOOMING SEASON: Flowering in July and August.

SIMILAR SPECIES: This species is very similar to *G. nana* and *G. squarrosa*. It is distinguished by having glandular, and often hairy rather than glabrous, stems.

Grindelia howellii **Photo by: Steve Shelly**

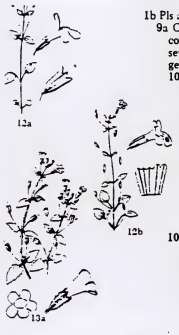


Grindelia howellii **Photo by: Steve Shelly**

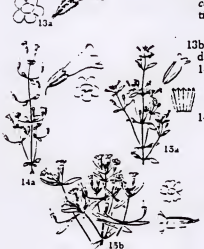


Mimulus L. Monkey-flower

Fls axillary; calyx strongly 5-angled, the midveins to the gen rather short lobes prominent and often raised; corolla = bilabiate, yellow to purple or red, the upper lobes external in bud; stamens 4, didynamous, all with well developed anthers; stigmas gen distinct, or sometimes marginally connate into a funnelf structure; caps loculicidal, sometimes splitting across the septum; seeds ∞; herbs (ours) with opp, entire or toothed lvs. (Diminutive of L *mimus*, a mimic).



1b Pls ann, without stolons or rhizomes; other features various
9a Corollas yellow, often marked with red; peds elongate, gen > calyx; corollas (except sometimes in no 14) gen deciduous before withering; septum of caps remaining intact, or splitting only above the middle; spp. gen of moist or wet places of middle and lower elev (to high elev in no 14)
10a Corolla strongly bilabiate, the lower lip evidently > upper and strongly deflexed from it; corolla at least 8 mm; principal lvs of fairly broad form and gen petiolate
11a Upper calyx tooth obviously > others; ann forms of no 4 (esp var. *depauperatus*) keyed with the per spp.
11b Upper calyx tooth ca = others, or smaller
12a Corolla pubescent on the palate, sometimes finely red-dotted, but without a prominent blotch; calyx teeth all = alike, gen acute; E Cas in Ore, Wn, and n Ida; Wn m. 9 M. washingtonensis Gand.
12b Corolla glab, bearing a prominent maroon blotch at base of lower lip; upper 3 calyx teeth acute, lower 2 longer and rounded; shady places, esp in moss mats on cliffs, in and W Cas; chickweed m. 10 M. alsinoides Dougl.
10b Corolla only slightly bilabiate, the lower lip only slightly > upper and not much deflexed from it; corolla often < 8 mm; lvs diverse
13a Lvs abruptly contracted to the petiole; herbage gen evidently viscid-pubescent, or sometimes only shortly and inconspicuously so; corolla 6–14 mm; gen E Cas; many RM pls. called var. *membraneus* (A. Nels.) Grant, are small, few-fld, and thin-lvd, with relatively long petioles and inconspicuous pubescence; purple-st m. 11 M. floribundus Lindl.



13b Lvs tapered to the petiolar or sessile base; herbage finely glandular-puberulent
14a Corolla 8–16 mm, gen 2–3 times as long as calyx; peds gen 1–1.5 cm at anthesis, tending to become arcuate-spreading or strongly divergent in fr; e base of Cas, from s Wn s; Pulsifer's m. 12 M. pulsiferae Grav
14b Corolla 4–8 mm, slightly > calyx; peds shorter, < 1 cm at anthesis
15a Lvs gen rather narrowly elliptic or rhombic-elliptic, gen short-petiolate; calyx teeth = acute; fr peds tending to be loosely ascending; moist, open places in valleys and plains E Cas, not reaching Mont; short-fld m. 13 M. brevifloras Piper
15b Lvs narrower, linear to narrowly oblong or oblanceolate, sessile or the lower short-petiolate; calyx teeth tending to be rounded-mucronulate; fr peds tending to be widely spreading, with suberect tip; open, moist to dry places at various elev; Mt Adams, Wn, and s; Suksdorf's m. 14 M. suksdorfii Gray

Cyperus L. Flatsedge; Cyperus

Spikelets several–many, in 1 or gen several capitate to spicate clusters, the terminal cluster gen sessile or nearly so, the others borne on = elongate rays from axils of sheathless, lfy involucral bracts; scales of spikelet arranged in 2 vertical rows; fls ☿, borne singly in axils of the scales; perianth none; stamens 3 (1–2); style bifid or more often trifid, achene accordingly lenticular or trigonous; ann or gen per herbs with mostly triangular, solid sts, lvs with closed sheath and gen elongate, grasslike bl. (*Gr Kyperos*, the ancient name).

1a Spikelets borne in very short, = capitate clusters with a very short rachis; pl ann; rachilla wingless; stamens 1 or 2, rarely 3

2a Pistil bicarpellate; stamens 2 (3); scales gen 2–2.5 mm, straight, blunt; pl 0.5–2 (3) dm; wet places, lowl, tolerant of alkali; widespread in US and s Can, but more common e, and rarely collected in our area, s to S Am; shining f, or c. . . . . 1 C. rivularis Kunth

Fls in pedunculate, ± capitate spikes or racemes, often involˊpapilionaceous, white, yellow, or pink to red or purple; calyx 5-toothed, teeth entire to 3-fid; corolla withering-persistent; stamens 10, diadelphous; pod globose to elongated, gen included in calyx, indehiscent, 1–several-seeded; ann or per herbs, often rhizomatous, with palmately to semipinnately 3-foliolate (sometimes palmately 4–9-foliolate) lvs and membranous to foliaceous stips. (L. name, referring to the trifoliolate lvs).

1a Pl ann
- 2a Heads involˊ — Group I, lead 11a
- 2b Heads not involˊ — Group II, lead 18a

1b Pl per
- 3a Fls subtended by an involˊ, bracts 1–4 (–12), distinct to connate, 0.5–2 mm
  - 4a Heads 1–4-fid; pl 1–3 cm, densely matted, strongly taproooted; involˊ bracts gen 1–4; fls lilac-purple, aging brown, 15–22 mm; alp or subalp in RM; sw Mont to NM; dwarf c. — 1 T. nanum Torr.
  - 4b Heads several-fid; pl mostly much > 3 cm
    - 5a Pl evidently pubescent, esp on calyx
      - 6a Calyx inflated and bladderˊy in fr; pl rhizomatous, not strongly pubescent except on calyx, 5–30 cm; fls 4–6 mm; European weed in waste places; Wn, Ore, and Ida in our area; strawberry c. — 2 T. fragiferum L.
      - 6b Calyx not inflated or bladderˊy in fr; pl strongly pubescent, matted, taproooted, 1–3 cm; fls 10–20 mm; alp and subalp slopes; RM, c Mont to Colo and e Utah; whip-root c. *(T. wintense)* — 3 T. dasyphyllum T. & G.
    - 5b Pl glab or subglab, at least on calyx
      - 7a Pl matted, taproooted, 1–5 cm; heads on scapelike peduncles; involˊ bracts 6–12, distinct, entire-margined; fls 11–22 mm, dark reddish-purple, aging brown; subalp to alp meadows and stream banks; RM, Mont and adj Ida to NM and e Utah; Parryˊs c. *(T. montanense)* — 4 T. parryi Gray
      - 7b Pl lfy-std, rhizomatous, mostly 10–80 cm; heads axillary on short peduncles of lfy sts; involˊ bracts 8–12, connate, margins toothed; fls 10–18 mm, reddish to purple, often white-tipped; meadows and stream banks to coastal dunes; BC to Cal and Mex, e to Ida, Colo, and NM; springbank c. *(T. fimbriatum, T. heterodon, T. spinulosum, T. willdenovii)* — 5 T. wormskjoldii Lehm.
- 3b Fls not subtended by a true involˊ, but sometimes stips of upper lvs ± involˊ-like
  - 8a Lflets commonly > 3; fls gen 30–100 per head, mostly > 18 mm; rachis of head not prolonged bevond upper fls
    - 9a Lflets linear to lanceolate, acute; calyx pubescent but not plumose; fls bright reddish-lavender to orchid, 18–22 mm; dry grassy hillsides just below ponderosa pine woodˊ; known onlyˊ from Swakane Canyon, Chelan Co, Wn; Thompsonˊs c. — 6 T. thompsonii Morton
    - 9b Lflets oblanceolate to obcordate; calyx teeth plumose; fls pinkish to pinkish-rose, 22–28 mm; rocky places in sagebr des to ponderosa pine woodˊ; e Cas, sc Wn to Nev, e to w Ida; big-head c. *(T. macrocephalum)* — 7 T. macrocephalum (Pursh) Poiret
  - 8b Lflets mostly 3, if > 3 then either fls mostly < 30 per head and < 15 mm, or rachis of head extending well past upper fls
    - 10a Calyx glab or only sparsely pubescent with scattered hairs — Group III, lead 28a
    - 10b Calyx strongly pubescent to villous or plumose — Group IV, lead 35a

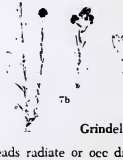
Group IV

35a Heads 50–200-fid, sessile or with peduncles < subtending lvs; stips of upper lvs forming a false involˊ; fls deep red, 15–20 mm; European, often cult, now furlyˊ widelyˊ intrˊ; red c. — 35 T. pratense L.

35b Heads sometimes few-fid, pedunculate, either peduncles > lvs or upper stips not involˊ

- 36a Peduncles mostly < lvs; lflets thick and leathery, gen not > 2.5 cm and with < 30 serrations; pl seldom > 1.5 dm; heads gen < 15-fid; fls white to pink, 8–14 mm; mostly dry soil of sagebr des to ponderosa pine for; ne Ore to ne Cal, e to Mont, NM, and Ariz; hollylf c.; ours the var. *plummerae* (Wats.) Martin — 36 T. gymnocarpon Nutt.

T. gymnocarpon



white c.; ours is var. *thermale* (E. Nels.) Cronq. *(G. t.)*
7 G. microcephalum Nutt.

7b Ann or bien; lvs merely adnate-aur, often broader than in no 7, sometimes oblong or lanceolate; pls more copiously and loosely tomentose than no 7; invols gen with a more yellowish cast, tending to be grouped in 1 or a few dense glomerules; widespread cordilleran sp., sometimes weedy, gen in moister soil than no 7; cotton-batting pl
8 G. chilense Spreng.

Grindelia Willd. Gumweed; Gumplant; Resinweed; Grindelia

Heads radiate or occ discoid, the rays gen 10–45, ♀ and fertile, yellow; involˉ ± resinous or gummy, its bracts firm, herbaceous-tipped, imbricate or subequal; receptˉ flat or convex, naked; disk fls yellow, the inner and often also the outer sterile; anthers entire or nearly so at base; style brs flattened, with marginal stigmatic lines and an externally hairy, lance-linear or occ very short appendage; achenes compressed to subquadrangular, scarcely nerved; pappus of 2–several firm deciduous awns, often ± serrulate; ann, bien, or per herbs, ours all gen < 1 m, with alt, ± resinous-punctate lvs and several or ∝ medium-sized to rather large heads, the disk in ours 1–3 cm wide; our spp. gen fl midsummer to fall. (David Hieronymus Grindel, 1776-1836, Russian botanist).

1a Heads discoid; bien or short-lived per, glab; lvs entire or with some small teeth, narrow, seldom > 10 × 1.5 cm; involˉ nearly of no 5; gen in gravelly or sandy places along streams; e Wn and extreme n Ida, and down the CR to Portland; CR g. *(G. nana* var. *discoidea)*
1 G. columbiana (Piper) Rydb.

1b Heads radiate

2a Tips of involˉ bracts loose or spreading, but not reg reflexed; involˉ only slightly or moderately glutinous; herbage ± villous to sometimes glab; per; rays gen 10–35; W Cas; WV g., PS g., 2 vars. 2 G. integrifolia DC.

a1 Rays short, gen 8–12 mm; various nonmaritime habitats in PT, from s VI to s WV var. integrifolia

a2 Rays longer, gen 12–20 mm; heads ave a bit larger than in var. *integrifolia*; salt marshes and rocky shores, coastal, Alas to n Cal, common about PS *(G. stricta)* var. macrophylla (Greene) Cronq.

2b Tips of involˉ bracts (at least the middle and outer) reg reflexed; involˉ often ± strongly resinous; herbage glab except in no 3; chiefly E Cas

3a St glandular and ± villous, at least in infl; prob bien; heads of no 5; n Ida and adj Mont, rare; Howell's g. 3 G. howellii Steyerm.

3b St essentially glab; widespread spp.

4a Rays gen 12–25, rarely more on some heads of robust pls; lvs entire or sharply toothed, not at all callous-serrulate; involˉ seldom strongly resinous; achenes gen with 1 or more short knobs on apical margin; per; common in e Ore and Wn and adj Ida, less common in Mont; low g.; we have 2 vars. 4 G. nana Nutt.

a1 Heads relatively small, the involˉ to ca 1 cm high, the disk to 1.5 cm wide; involˉ bracts relatively short-tipped; pls relatively small and narrow-lvd; e Wn and adj Ida, s to Union Co, Ore var. nana

a2 Heads larger, the involˉ 1–1.7 cm high, the disk to 2.5 cm wide; green tips of involˉ bracts longer; more generally distributed, but not in range of var. *nana* var. integrifolia Nutt.

4b Rays gen 25–40, occ fewer on some heads of small pls; lvs reg callous-serrulate to sharply toothed or entire; involˉ strongly resinous; achenes gen without apical knobs; bien or short-lived per; common in Mont and Ida, less common w; resin-weed, curly-cup g.; we have 3 vars. 5 G. squarrosa (Pursh) Dunal

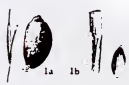
a1 Lvs entire or remotely serrulate, or (especially the lower) coarsely and irreg toothed or incised; gen short-lived per; native *(G. perennis)* var. quasiperennis Lunell

a2 Lvs closely and evenly serrulate or crenate-serrulate; gen bien; intro in our range

b1 Upper and middle lvs 2–4 times as long as wide, gen ovate or oblong var. squarrosa

b2 Upper and middle lvs 5–8 times as long as wide, gen linear-oblong to oblanceolate *(G. s.)* var. serrulata (Rydb.) Steyerm.

Fls small, capitate to cymose or pan, perianth greenish to brown or purplish-brown, the segms (tepals) in 2 rather similar series of 3 each; stamens 3 or 6 (rarely only 1 or 2); pistil 3-carpellary, stigmas linear; style 1; ovary superior. 1- or 3-celled; fr caps, 3-valved, with 3 or with ∝ seeds; seeds often appendaged at 1 or both ends; ann or per, often rhizomatous herbs with simple, mostly terete sts and alt, terete to grasslike lvs with open or closed sheathing bases.



1a Seeds 3; lvs with closed sheaths, the bls often with long straight marginal hairs ..... Luzula
1b Seeds ∝; lvs with mostly open sheaths, the bls rarely at all hairy ..... Juncus

Juncus L. Rush

Fls few (rarely only 1) to ∝ in a terminal, essentially cymose, open and pan-like to greatly congested infl, sometimes in 1 – ∝ capitate clusters, lowest (involl) bract of infl from greatly elongate to reduced, flat to terete, when terete the infl often seemingly lateral on the st; stamens gen 6 or 3, rarely only 1 or 2, filaments from < to much > the anthers; caps 1-celled with 3 parietal placentae or placentae intruded and caps 3-celled; seeds ∝, gen = fusiform, often appendiculate at 1 or both ends, faintly areolate or reticulate; ann or per, caespitose to strongly rhizomatous herbs with terete to flattened, lfless to lfy fl sts; lvs sheathing at base, the sheath often extending upward on the sides at the juncture with the bl, the projections rounded to pointed (termed auricles, but rarely extending outward as do the aurs of the grass lf); bls from terete to laterally or dorsiventrally flattened, often septate within. (Classical Gr name for the rush).

1a Pls ann, gen diminutive, much < 1 dm (except *J. bufonius*); lvs narrow, often involute, rarely > 1 mm broad
2a Pl rarely as much as 4 cm, scapose, the fls 1–2 (3) in a terminal head on a naked fl st; stamens 3
3a Bracts lacking at base of the single terminal fl, known from Harney and Lake cos, Ore, and Gooding Co, Ida, and not improb within our range in Ore or Ida ..... J. abjectus Herm.
3b Bracts (1 or 2) present at base of the 1–3 fls
4a Bracts single, truncate, scarcely 0.5 mm (but much broader), nearly surrounding base of the solitary fl; tepals gen at least 3 mm; presently not known n of Lake Co, Ore, but possibly reaching our area ..... J. uncialis Greene
4b Bracts mostly 2, if single then acute to acuminate and not surrounding base of the perianth, at least 1 of them gen almost 1 mm
5a Bracts very unequal, upper one ca 1 mm, lower one much reduced or even lacking; seeds very indistinctly reticulate to smooth; caps thin-walled, ca 0.5 mm > the narrowly lanceolate tepals; fls 1 per peduncle; mud flats, vernal pools, and moist to wet meadows; Klickitat Co, Wn, and from Columbia Co, Ore, s through WV to Josephine and Lake cos, widespread and largely mont in Cal; dwarf r. *J. uncialis*, misapplied) ..... 1 J. hemiendytus Herm.
5b Bracts subequal, mostly 1–1.5 mm; seeds rather prominently reticulate or ridged; caps rarely > tepals; fls often > 1 per peduncle
6a Seeds prominently ridged lengthwise and less strongly crosslined; caps ca = tepals; tepals 2.5–3.5 mm, abruptly acute or short-acuminate, not minutely roughened; damp or wet areas from open fields to moist meadows at medium elev; Vl, along CR, Klickitat Co, Wn, and Columbia and Hood R cos, Ore, s through WV and sw Ore to s Cal; Kellogg's r. *J. brachystylus*, *J. triformis* var. *b.*) ..... 2 J. kelloggii Engelm.
6b Seeds not prominently ridged lengthwise, caps scarcely 3/4 as long as tepals; tepals gradually narrowed to acicular, spreading and minutely roughened tips; known in Ore only from Harney Co, but possibly n into our area ..... J. capillaris Herm.
2b Pls gen > 4 (3–30) cm; fls gen lateral as well as terminal on st; stamens 6; tepals 3–7 mm; seeds apiculate at each end, moist areas gen, from near sea level to midmont, throughout much of N Am; Eurasia; a bad garden weed w Cas; toad r. (*J. sphaerocarpus*, misapplied) ..... 3 J. bufonius L.
1b Pls per, gen at least 1 dm; lvs often much > 1 mm broad
7a Infl apparently lateral, lowest involl bract terete, erect, apparently a continuation of the st
8a Fls gen 1–4 (6–7) per st; involl bract rarely as much as 5 cm; caps ca = or slightly > the perianth; pl alp (or subalp)
9a Uppermost of the basal sheaths of the st with a well-developed bl mostly 2–7 cm; caps sometimes acute
10a Caps retuse; tepals acute, 4–5 mm; pl 2–3 (4) dm; RM, sc Mont to Colo; Hall's r. ..... 4 J. hallii Engelm.
10b Caps acute; tepals acuminate, 6–7 mm; pl 0.5–3 dm; BC s, in Cas and OM of Wn, to Cal, e to RM, sw Alta to Colo; Parry's r. (*J. drummondii* var. *p.*) ..... 5 J. parryi Engelm.
9b Uppermost of the basal sheaths bladeless or with a bl scarcely 1 cm; caps retuse; tepals (4) 5–7 mm; Alas to Cal, in both OM and Cas, e to RM from Alta to NM; Drummond's r.; 2 vars. ..... 6 J. drummondii E. Meyer

wanting, irreg distributed E Cas, to Cal and Colo, but absent from Ore; Hooker's b.; ours chiefly in 4 copiously intergrading vars. 9 B. hookeri Nutt.

a1 Invol strigose or sericeous to hirsute or hispid, scarcely woolly

b1 Lvs and invol sericeous or sericeous-strigose, the lvs often only once pinnate; pls dwarf; Klickitat Co, Wn var. hookeri

b2 Lvs glandular and hispidulous, gen > once pinnate; invol sparsely hispid or hirsute-hispid; pls larger, chiefly SR plains, to Nev and Utah, but also near Yakima, Wn var. hispidula (Sharp) Cronq.

a2 Invol ± woolly

c1 Pls relatively large and robust, with broad, gen uncut lf segms; Adams, Gem, and Wn cos, Ida var. idahoensis (Sharp) Cronq.

c2 Pls smaller, and with more-dissected lvs, but not so small as var. *hookeri*; e Wn, but not Klickitat Co var. lagocephala (Sharp) Cronq.

Bellis L. Bellis; Daisy

Heads radiate, the rays ♀, white to pink or purple; invol bracts herbaceous, =; recep conic, naked; disk fls ☿, yellow; style brs flattened, with introrsely marginal stigmatic lines and short, deltoid or ovate, externally short-hairy appendages scarcely longer than broad; achenes compressed, gen 2-nerved; pappus wanting, ann or per herbs, scapose or nearly so, with solitary heads. (L *bellus*, pretty).

B. perennis L. English d., lawn d. Spreading-hairy per; lf bls elliptic or obovate to orbicular, toothed, to 4 × 2 cm, = or > petiole; scape 5–20 cm; disk 5–10 mm wide; rays ∝, ca 1 cm or less; weed in lawns and waste places, adventive and ± estab across n US, in our range chiefly W Cas; fl Mar–Sept.

Bidens L. Beggar-ticks; Beggars-tick; Bur-marigold; Sticktight

Heads radiate or discoid, the rays if present neutral (♀), yellow, seldom white or pink; invol bracts biseriate and dimorphic, the outer ± herbaceous, often very large, the inner membranous, often striate; recep flat or a little convex, chaffy throughout, its bracts narrow, flat or nearly so; disk fls ☿; anthers entire or minutely sagittate; style brs flattened, with externally hairy, gen short appendages, without well marked stigmatic lines; achenes flattened parallel to the invol bracts, not winged, often merely compressed-quadrangular, occ almost reg tetragonal, rarely *(B. beckii)* subterete; pappus of 1–6 (gen 2–4) awns or teeth, gen retrorsely barbed, sometimes antrorsely barbed or even barbless, rarely obsolete; ann to per herbs (shrubs), with opp, simple to dissected lvs; fl summer, into fall. (L, meaning two teeth, referring to the pappus).

1a Aquatic per with the submersed lvs filiform-dissected, the emersed ones gen merely serrate; achenes subterete, 10–14 mm, < the 3–6 pappus awns; rays 1–2 cm; ponds and slow streams; e Am sp., intro in Ore, Wn, and s BC; water marigold 1 B. beckii Torr.

1b Terrestrial or semi-aquatic ann, without filiform-dissected lvs; achenes flat or compressed-quadrangular, > the 2–4 pappus awns

2a Lvs, except sometimes the lowermost, sessile; outer invol bracts gen spreading or reflexed; rays 4–15 mm, or none

3a Principal lvs deeply tripartite; achenes truncate; rays < 1 cm; VI; VI b. 2 B. amplissima Greene

3b Lvs all merely toothed to subentire; summit of mature achenes convex and cartilaginous (unique among our spp. in this regard); rays to 1.5 cm, or none; widespread; nodding b., s. 3 B. cernua L.

or hirtellous at least in infl; lvs narrowly linear; lady's b., yellow b. 12 G. verum L.

10b Fls solitary or few in small, rather inconspicuous infls; sts weak, tending to recline or scramble on other vegetation, gen retrorse-scab on angles; corolla 3-lobed or less often 4-lobed

13a Fls solitary or 2–3 at ends of axillary or terminal peduncles which may themselves be borne in 3's; corolla small, gen 1–1.5 mm wide; common, widespread circumboreal sp.; small b., small c.; ours is var. *pacificum* Wieg. (*G. brandegei*, a depauperate form; *G. subbiflorum*) 13 G. triflidum L.

13b Fls several in small, irreg br, basically cymose infls; corolla larger, gen 2–3 mm wide; gen W Cas and esp coastal (incl PS), occ inl to nw Mont; Pac b. 14 G. cymosum Wieg.

Kelloggia Torr. Kelloggia

Fls ☿, in open, terminal, cymose infls, gen 4–5-merous; calyx teeth short; corolla funnelf-salverf, valvate; ovary 2-celled, with a solitary, erect, basally attached ovule in each cell; style slender, bifid at tip; fr small, dry, indehiscent, covered with hooked bristles as in *Galium*; endosperm well developed; per herbs with opp, entire, sessile lvs and small interpetiolar stips. (Albert Kellogg, 1813–1887, Cal botanist).

K. galioides Torr. Glab, rhizomatous and sometimes also taprooted, sts ± clustered, 1–6 dm; lvs lanceolate or lance-linear, gen 1.5–5 cm × 2–15 mm; fls long-ped, corolla pink or white, 4–8 mm, the shortly hispid, ascending-spreading, narrow lobes nearly = the slender tube; stamens and style shortly exserted; fr 3–4 mm, the 2 halves readily separable; widespread at mid to high elev E Cas, also in OM.

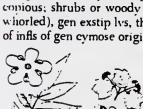
Sherardia L. Blue Field-madder; Herb Sherard; Spurwort

Fls ☿, borne in small heads with a basal involucre of lflike bracts; calyx teeth 4–6, lanceolate, well developed; corolla funnelf, the slender tube evidently > the 4 valvate lobes; ovary 2-celled, with a solitary ovule attached near base of septum in each cell; style bifid at tip; stigmas capitate; fr dry, crowned by the persistent sepals, dicoccous, the carpels indehiscent; endosperm well developed; ann with habit of *Galium*. (William Sherard, 1659–1728, a patron of botany).

S. arvensis L. Sts slender, 0.5–3 dm, spreading-hairy or retrorsely scab; lvs in whorls of ca 6, 0.5–2 cm, stiffly hirsute above, the antrorsely scab, ± cartilaginous margins confluent distally into a firm point, heads on axillary and quasi-terminal, naked peduncles, involucre of (7) 8 (10) shortly connate bracts 4–9 mm; corolla 3 mm, pinkish; fr scab-strigose, 2 mm exclusive of the prominent, pointed sepals; Mediterranean weed, intro W Cas.

CAPRIFOLIACEAE Honeysuckle Family

Fls reg or irreg, ☿ (or the marginal ones sometimes neutral), gamopet, epig; calyx ± evidently 3–5-lobed; corolla gen 5-lobed, sometimes bilabiate, the tube sometimes spurred or gibbous; stamens epipetalous, gen 5 and alt with corolla lobes (only 4 in *Linnaea*); pistil 2–5-locular, with 1-several pendulous ovules in each locule, sometimes only 1 locule fertile; stigma capitate or 2–5-parted, the style elongate or obsolete; fr indehiscent, gen fleshy (dry in *Linnaea*); endosperm copious; shrubs or woody vines, less often herbaceous or arborescent pls, with opp (rarely alt or whorled), gen exstip lvs, the stips when present gen small and adnate to petiole; fls in various sorts of infls of gen cymose origin.



1a Style very short or none, stigmas sessile or nearly so; infl br and gen with ± ∝ fls, umbelliform to corymbiform or paniculiform; corolla rotate to shortly open-camp; fr drupaceous

2a Lvs pinnately or bipinnately compound; fr with 3–5 small, seedlike stones Sambucus

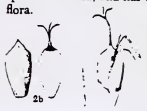
2b Lvs simple, sometimes lobed; fr with 1 large stone Viburnum

1b Style well developed, ± elongate; infl various, of paired fls ending a peduncle, or of short racemes or spikes, or of sessile verticils on an elongate or

CYPERACEAE Sedge Family

Fls much reduced, ☿ or ♂ ♀ (pls then monoecious or seldom dioecious), sessile in spikes or spikelets, apparently or truly axillary to small bracts (scales); perianth of 1–∝ (often 6) short or elongate bristles, or lacking; stamens gen 3, or only 1–2, exserted at anthesis (pls wind pollinated); ovary superior, tricarpellate or less often bicarcellate, the style correspondingly 3-cleft or 2-cleft; ovary 1-celled, 1-ovuled; fr an achene; fibrous-rooted, often rhizomatous herbs, often grasslike, the culm triangular to terete, solid or seldom hollow; lvs mostly 3-ranked and with closed (rarely open) sheath and parallel-veined, typically elongate and grasslike blade, or some or all lvs with reduced or no blade.

Bulbostylis capillaris (L.) Clarke, a small, tufted ann with filiform lvs and few spikelets with spirally arranged scales, no perianth, and 3-angled achenes with a minute tubercle, is a widespread sp. s of our area, and has been reported for Ore, but is not clearly known to be an element of our flora.



1a Achene enclosed or enwrapped in a small bract (perigynium—abbreviation peri) as well as subtended by a scale
2a Peri (gynium) open, with unsealed margins, merely wrapped around the achene ..... Kobresia
2b Peri closed (except at the tip), though often showing a dorsal suture distally ..... Carex

Carex L. Sedge

Pls ♂ ♀ or seldom ♂, ☿; fls naked, borne in spikes, each subtended by a gen small and scarious bract (scale); spikes 1–∝, each gen subtended by a large and lfy to much-reduced and inconspicuous bract which may or may not be sheathing at base, or this bract wanting; individual spikes sessile or pedunculate, racemosely arranged in a loose to tight terminal infl, sometimes some of them well removed from the others and axillary to lvs near base of st; spikes unisexual or bisexual, when bisexual the ♂ fls terminal (spikes androgynous) or basal (spikes gynaecandrous) or seldom ± intermingled with the ♀ ones; stamens 3 or occ 2; ☿ fls each enclosed by a sac-like bract called a peri (gynium), from the mouth of which the style or stigmas protrude, and subtended by an open scale (the pistillate scale); stigmas 2 or 3 (rarely 4), achene accordingly 2 or 3 (-4)-sided; grasslike per herbs with 3-ranked lvs, closed sheaths, and triangular to round, solid sts. (The classical L name).

The peri is a highly modified bract on the adaxial side of the ☿ fl; it is wrapped around the fl, its margins being connate, forming an enclosing sac with a minute apical opening. The side of the peri next to the scale (the abaxial side) is called the dorsal side, and the side next to the spike axis (the adaxial side) is the ventral side.

The lowermost lvs are frequently very much reduced, with a short, nongreen bl that is often firm, pointed, and ± sheathing, the true closed sheath then often being short or absent. When the lowermost lvs are of this type, with the foliage lvs being borne farther up the st, the pl is said to be aphyllopodic; when the lowest lvs are normally developed, the pl is said to be phyllopodic. The distinction is not absolutely sharp, many spp. being slightly aphyllopodic, with 1–2 reduced lvs at the bottom but with foliage lvs still arising near the base of the culm.

Many characteristically tristigmatic spp. occ have a few distigmatic fls; such specimens should be keyed as being tristigmatic. With few exceptions (esp *C. saxatilis*), our distigmatic spp. only rarely produce any tristigmatic fls.

All students of *Carex* admit that the spp. must often be recognized by small technical differences, esp in the details of the structure of the peri. Often therefore precise measurement of the mature peri and achene may be necessary for accurate identification; immature specimens often are not keyable.

In addition to the spp. formally treated here, the European sp. *C. arenaria* L. has been collected several times on ballast at Portland, Ore. In the key it will fall between *C. siccata* and *C. sartwellii*, differing from both in having the bracts subtending the lower spikes strongly setose-prolonged and surpassing the spike.

1b Spikes 2–∝ (in no 35, 1 spike terminal and 1 or more basal or nearly so); peri never containing a rachilla; small to large pls
2a Stigmas 2 or 3 (4) and the achene accordingly lenticular or trigonous (or quadrangular); if stigmas 2 then the spikes elongate and cylindric (the larger ones seldom under 1.5 cm), or at least some of them evidently pedunculate, or both; peri gen without a dorsal suture
3a Style continuous with the achene and of the same bony texture, not withering, often becoming flexuous or contorted; stigmas 3 and achene trigonous, except in no 20; lvs often septate nodulose
Group II (lead 25a)
3b Styles deciduous; other characters various
4a Stigmas 3 (4) and the achene trigonous (quadrangular); a few lenticular, distigmatic achenes seldom intermingled with the others
5a Peri pubescent (*C. scirpoides*, a ± ♂, ♀ sp., might be sought here, but more properly belongs with Group I, where it is keyed)
Group III (lead 32a)
5b Peri glab (glandular-papillate in *C. californica)*
Group IV (lead 41a)
4b Stigmas 2 and achenes lenticular
Group V (lead 75a)
2b Stigmas 2 and achenes lenticular; spikes sessile and relatively short (seldom > 1.5 cm), not elongate and cylindric; peri gen with a ± evident dorsal suture, at least distally
6a Spikes androgynous, or pl ± ♂, ♀ and most or all of the spikes unisexual
Group VI (lead 88a)
6b Spikes gynaecandrous, or some of the lateral ones wholly ♀
7a Peri planoconvex, often with raised margins, but not thin-edged
Group VII (lead 107a)
7b Peri planoconvex or flattened, evidently thin-edged or wing-margined
Group VIII (lead 117a)

Subgroup VIIIb

139a ♀ scales distinctly shorter and narrower than the peri, largely exposing at least the distal margins as well as the beak of the peri

140a Dorsal surface of the peri relatively few-nerved, the nerves evident (except sometimes in *C. crawfordii*) but < 10
141a Peri 2.5–5 times as long as wide; achenes very narrow, only 0.8–0.8 mm wide
142a Peri either at least 4 mm or > 3 times as long as wide; beak of peri becoming slender and subterete in the distal 0.2–0.5 mm
143a Peri 3.3–4.0 × 0.8–1.0 mm, 3.5–4.8 times as long as wide, planoconvex and not much wider than the achene; achene 1.0–1.3 mm (see lead 132a) 120 C. crawfordii Fern.
143b Peri 4.1–5.5 × 1.5–2.0 mm, 2.5–3.0 times as long as wide, strongly flattened and much wider than the achene; achene 1.3–1.8 mm; moist to wet ground at low elevs, chiefly where humid; widespread N Am sp., W Cas with us; pointed broom s.
128 C. scoparia Schk.

143b